# ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Vol. XXXIII, No. 12


## TABLE OF CONTENTS.


ENGINEERING NEWS OF THE WEEK....185, 190

The New Electric Underground Railway in Budapest (with inset)..... 186
Diagram of Comparative Weights of Railway Bridges (illustrated) ..... 187
Tests of Lap-Welded Iron Pipe (illustrated)..... 187
Stopping the Flow of Water in a Drill Hole.... 188
Two New Conduit Electric Railways (illustrated). 188
Damp-proof and Fireproof Construction for Mills. 189
Rapid Transit in Large Cities..... 189
Recent Progress in Railway Car Lighting..... 191
Power Development from a Mine Drainage Tunnel..... 191
Specifications for Buffalo Grade Crossing Work, N. Y. C. & H. R. R. R..... 195
A Water-Cooling Apparatus (illustrated)..... 196
Casting Rail Joints Solid for Continuous Rails.. 197
The New Building of the Institution of Civil Engineers..... 198
Special Contractor's Shovel (illustrated)..... 198
Contracts for Surveys of Government Lands.... 198
Legal Decisions of Interest to Engineers..... 199

EDITORIAL NOTES ..... 192

The First Engineers' Society in the United States—An Apparatus for Cooling Hot Water—Grade Crossings on Electric Railways—Competition Between Electric and Steam Railways in New England—The Consolidation of New York Libraries—The Desirability of a Library for Engineers.

EDITORIAL:

Underground or Elevated Construction for the New York Rapid Transit Railway..... 193

LETTERS TO THE EDITOR.....194-195

The Importance of Testing Aneroid Barometers Before Using—The Oldest Engineering Society in the United States—Adapting the Bear-Trap Gate to Canal Locks—The Reversion Level—The Ferris Wheel Analysis in "Modern Framed Structures"..... 194-195

BOOK REVIEWS .....199-200


A ball-nozzle for fire-extinguishing purposes has been invented by C. K. Pollock, of Des Moines, Iowa, utilizing the mechanical principle of the familiar glass-ball sustained in the air by a vertical jet of water. In this case the nozzle is bell-shaped, and contains a hard rubber ball. The resulting stream is funnel-shaped, which in many cases would be more effective than a solid stream, as it covers a much larger area. Back-pressure, due to the old contracted nozzle, is also avoided; but both the ordinary and the ball-nozzle are combined in one, controlled by a proper cut-off valve.

Bids for a new water supply for Jersey City will be received until 11 a. m. March 25. Four different plans are specified, as outlined and discussed in our issues of Jan. 24 and 31, Feb. 7, and March 7. Mr. Geo. T. Bonton is Clerk of the Board of Street and Water Commissioners.

The Great Falls dam, on the Potomac River, is to be raised 2½ ft., and work is to commence at once under an appropriation of $125,000 for this purpose made by the last Congress. Col. Elliot, of the U. S. Engineers, is in charge.

The cost of making charcoal pig iron in Texas is given as $9.50 per ton by Mr. William Kennedy, of Austin, Tex., in a recent communication to the American Institute of Mining Engineers. The charcoal used is made in bee-hive ovens, and costs 4 cts. per bushel. The expense of manufacture per ton of iron is distributed as follows:

| | |
|---|---|
| 2¼ tons of ore | $2.05 |
| 110 bushels of charcoal | 4.40 |
| ½ ton of limestone | .75 |
| Labor and salaries | 1.50 |
| Interest | .30 |
| Repairs and incidentals | .50 |
| Total | $9.50 |

The average daily water consumption in New York city in 1894 was 183,000,000 gallons, of which 36,712,800 gallons passed through meters. Under a legislative statute no style or make of meter can be used which has not been approved by the Mayor, Comptroller and Chief Engineer of the Croton Aqueduct. The five styles of meters approved to the close of 1894, with the number of each kind in use on Jan. 1, 1895, were as follows, in order of numerical rank: Crown, 9,139; Thomson, 8,939; Worthington, 8,382; Nash, 3,862; Gem, 6. The last report of the department of public works, from which these facts are taken, states that "house owners who have to use meters have the choice between any of the five makes and styles." Assuming the population of New York to be 1,950,000, the report says, the average daily consumption of water in 1894 was 94 gallons per capita.

The most serious railway accident of the week was a derailment on the Atlantic & Pacific Ry. in Truxton canyon, New Mexico, on March 13. A freight train jumped the track on a down grade and the engine and eight cars were wrecked, the engineman and a brakeman being killed. A broken rail is given as the cause of the accident.——On March 15 a fast train on the Terre Haute & Indianapolis R. R. (Vandalia Line) ran into a switch engine near Terre Haute, Ind., but none of the passengers or trainmen were injured. The cars caught fire, and the baggage car, two express cars, and several freight cars on the side track were destroyed. The heat melted the coin and burned the bills in the safes of the Adams Express Co.'s car.

An embankment weakened by washouts gave way under a freight train on the Southern Ry., near Adams Park, Ga., March 14. The engine and six cars were derailed, and 100 ft. of track displaced.

A wooden highway bridge on the Valley Road, near Vicksburg, Miss., collapsed March 14, while being torn down, and part of the masonry abutment followed the bridge. The county road superintendent, Mr. Edwin McGinty, and another man were on the structure, and were both killed.

A sewer trench in Second Ave., Brooklyn, N. Y., between 57th and 58th Sts., caved in March 14, and two men were killed. The sheathing was burst in by the pressure of the sand.

Another elevated railway bumper collision occurred March 14, this time on the 34th St. shuttle branch of the New York elevated railway. The train was in charge of the fireman, the engineman being at dinner, and probably through inexperience or carelessness in handling the train ran into the bumper at the Third Ave. station. The fireman claims, of course, that the vacuum brake failed. One passenger was badly injured and two or three were cut and bruised. The necessity of and means for providing against such accidents were discussed in our issue of Jan. 17.

The roundhouse of the Wabash R. R., at Toledo, O., was burned March 17, and while several men were trying to get the engines out the roof fell, killing three men and injuring nearly twelve more.

An explosion of 3,000 lbs. of nitro-glycerine occurred March 15 at the Hancock Chemical Works, near Houghton, Mich. One man was blown to pieces.

The accidents on the Brooklyn electric railways are said to have resulted in killing 104 persons since the summer of 1892, when the electric system was first put in operation.

Natural gas has been struck at a depth of 965 ft. near Depew, N. Y., by the Depew Natural Gas Co., and arrangements are being made for developing the supply and utilizing it for fuel and lighting purposes.

The Union Terminal Ry., which forms a belt line round Kansas City, Mo., and Kansas City, Kan., will soon be completed. It is being built by the Missouri Pacific Ry., and will have 60 miles of track, of which about 48 miles are now in operation.

The annual inspection tours of the mechanical engineering classes of Cornell University will take place next week. The mechanical engineering party will visit the Bethlehem Iron and Steel Works, at Bethlehem, Pa.; the Midvale Steel Co. and the Baldwin Locomotive Works, at Philadelphia, Pa.; and the Washington navy yard. The electrical engineering party will visit the Brooklyn and New York power stations, Metropolitan Exchange and Crocker-Wheeler Electric Works at Ampere, N. J.; the power station of the Philadelphia Traction Co., the three-wire station of the Edison Illuminating Co., at Philadelphia, Pa., and the General Electric Co.'s works at Schenectady, N. Y.

A record for rapid rail rolling was made by the South Works of the Lackawanna Iron & Steel Co., at Scranton, Pa., for the week ending March 9. The converting mill made 6,042 tons of ingots in 11 turns, and the South rail mill rolled 5,201 tons of finished rails.

The last Congress provided that the President of the United States should appoint a board of three civil engineers to make a survey of the Nicaragua Canal route, and to ascertain "the feasibility, permanence and cost of construction" of such a canal. The act provides that one of the engineers shall be taken from the army, another from the civil engineer corps of the navy and a third engineer from civil life. The act provides that none of these engineers shall in any way have been previously identified with the Nicaragua Canal Construction Company.

The defects in the present system of rating closed feed-water heaters by horse-power capacity are recognised by many manufacturers and users of these heaters, and seven of the leading makers (members of the Feed Water Heater Manufacturers' Association) have adopted resolutions specifying that they believe that the only proper rating for feed-water heaters is one which is based upon the square feet of heating surface contained in the heater, and they therefore agree that in making prices upon heaters they will state the exact number of square feet of surface which they are offering, and also that they will state without reservation, both in catalogues and in specifications, the diameter of the tubes, the number of lineal feet thereof, and the total square feet of heating surface in each heater offered.

A decision important to the owners of mining tunnels has been rendered by Judge Hallett, of the U. S. Court of Appeals, in St. Louis, Mo. Under the old Colorado law of 1861 tunnel owners were given but 250 ft. on each side of the tunnel for the working of any veins or lodes discovered therein. This ruling is now reversed, and the discoverer of any vein not known to exist when the tunnel was located and commenced, is given the right to work it for 1,500 ft. on each side of the tunnel, or 3,000 ft. in all. The discovery or location of such veins on the surface subsequent to the location and commencement of the tunnel cannot deprive the owner of the tunnel claim. Judge Hallett says that the 250-ft. limit fixed by the act of the Colorado legislature in 1861, was rescinded by the act of Congress of May 10, 1872, and the act of the Colorado legislature of 1874. The case calling forth this decision is that of the Enterprise Mining Co. vs. the Rico-Aspen Consolidated Mining Co. In running the Enterprise tunnel a blind lead was followed which ran directly into a lead being run by the Rico-Aspen Co. In the legal conflict which followed, the Enterprise Co. won on the above ruling.

Krushite is being very successfully used in England for sawing and polishing granite and other hard stone. It consists of minute chilled cast metal shot, ranging in size from a powder to the size of clover-seed. Used as a substitute for sand, granite is sawn 4 ins. deep, and hard grit-stone 9 ins. deep, in an hour, with 12 blades in the machine. It is said to do the same amount of work as the diamond saw, at one-tenth the cost. In sawing and polishing stone, one ton of this krushite is equal to 300 tons of the sharpest sand, and the wear on the blades and the driving power required are said to be much reduced. The particles are intensely hard, without being brittle, as they will indent an anvil when struck upon it. They roll between the stone and the saw blades, and thus wear down the inequalities in the stone.

An intercepting sewer for the Des Plaines River Valley, to connect with the Chicago Drainage Canal, is being talked of, and Mr. W. S. Jones, of Cicero, Ill., is studying the scheme. A sewer 17 miles long, it is said, would take the sewage of 13 villages. Parks and boulevards are also being discussed in connection with the sewer, but the whole project is very indefinite as yet.

The intercontinental railway route, as surveyed under the auspices of the Pan-American Congress of 1889, is now accepted and approved by all the states interested. Lieut.-Commander R. M. G. Brown, U. S. N., the executive officer of the survey, has been engaged in the adjustment of this question for the last four years, and is now about to make his report to the government. He says it is now feasible to commence the construction of a railway, 4,900 miles long, from the southern boundary of Mexico to the northern terminus of the Argentine railway system. In this distance 230 miles are already constructed, and about 1,800 miles are under survey and construction. The longest link for construction would be that between the railways of Costa Rica and Cuzco, Peru, a distance of about 2,300 miles. In the 2,189 miles between Cuzco and Buenos Ayres some railways already built or projected could be utilized.

The new quarters of the U. S. Weather Bureau, in the Manhattan Life Insurance Co.'s new building in New York city, are located 384 ft. above sea level and 300 ft. above the street level. The weather bureau occupies the four upper stories of the tower, or the 21st to 24th stories. This tower contains a 20,000-c. p. signal light, enclosed in red glass, and a 12,000-c. p. light in white glass. A 12,000-c. p. searchlight is also contained in this tower, and can be seen from Asbury Park, 30 miles away.

Appropriations for irrigation ditches, roads, and bridges in Minnesota are declared by the Attorney-General of the state to be unconstitutional, except where grants of land or property have been made under a clause of the state constitution which provides that the state shall never contract any debts for works of internal improvement, or be a party in carrying on such works, except in case where grants of land or other property shall have been made to the state especially dedicated by the grant to specific purposes.

## THE NEW ELECTRIC UNDERGROUND RAILWAY IN BUDAPEST.*

(With Inset.)

The city of Budapest has won no small fame in engineering circles throughout the world from the successful operation for several years of an electric railway on the conduit system. This system was installed by the famous Berlin firm of Siemens & Halske, and the same firm is now engaged on a work in the same city of quite equal engineering importance—an underground railway to be operated by electricity and extending under some of the principal streets. The railway is a double-track line, about two miles in length, extending across the city. The reasons for placing the line underground are not so much to secure rapid transit as to avoid defacing and injuring Andrassy St., through which it passes, a famous thoroughfare, which is to Budapest what Fifth Avenue is to New York city. The city officials have repeatedly refused to grant franchises for the construction of surface railways in the street, and an elevated line, of course, would be out of the question.

The railway is located in the middle of the street, which, as seen by the perspective view, Fig. 3, is a broad one. The road approaches the curb line only at corners, where great pains is taken to avoid sharp curves. The sharpest have a radius of 40 m. (131 ft. 2¾ ins.). The maximum grade is only 2%, and this is necessitated by crossing a main sewer. The grade where the underground road rises to the surface is 1.8%.

Fig. 1 of the engravings on our inset sheet show cross-sections of the tunnel, one-half showing a typical cross-section where the excavation is deeper than the ground water level, and the other half a typical section in dry ground. Fig. 2 is a longitudinal section. It will be seen that much care has been taken to exclude water from the tunnel. The layer of material designated on the drawings as "asphalt felt" is intended to interpose a watertight barrier to the leakage of water into the tunnel, and it will be seen that it is not only laid beneath the invert, but roofs over the tunnel to protect it from any seepage of street drip. This asphalt covering was applied in sheets in two layers. The sheets were about 31½ ins. wide, and were laid so as to break joints. They were painted on the under side with sticky natural asphalt, and on the upper side with fluid asphalt.

The invert of concrete 0.5 m. (19 11-16 ins.) thick, shown in Fig. 1, is not required throughout the entire line, but is only introduced for a short distance of about 125 yds., where ground-water was encountered. Even including this invert the depth of excavation below the surface is only about 4.5 m. (14 ft. 9 ins.). Drain pipes are located under the center of each track, as shown; they do not connect with the sewers, but drain into small reservoirs at each station, from which the water is pumped by pumps operated by electricity.

The construction of the road was only possible through observing the greatest economy, for, while the line passes through the heart of the city, there are several surface railways on adjacent streets, which will, doubtless, be able to retain a good part of the traffic. The line has been designed for a capacity of from 3,000 to 3,200 car-km. (1,925 car-miles) per day. Each car holds about 50 persons and the speed contemplated is 20 km. (12.4 miles) per hour. The features of special interest, apart from the general system of construction, occur at points where the road is crossed by sewers, gas and water pipes; but such crossings are not numerous. Two main sewers have been projected in Budapest, one at Donau St. and the other at Ring St., which had to be considered in determining upon the grades.

Fig. 3 is a longitudinal section of the road at Ring St., showing the crossing of this sewer and of a large water-main beside it. As seen by this drawing, there was very scanty room between the sewer arch and the street surface for the tunnel. The difficulty was solved by dint of economizing at every point. The clear height in the tunnel and the thickness of the roof were reduced and the level of the street overhead was slightly raised. Further, the masonry arch of the sewer was cut away and replaced by a riveted iron cover with suitable stiffening rings, as shown in the drawing. Another noticeable feature of this drawing is the section of the Budapest electric conduit road on Ring St. It will be seen that the conduit is under one of the rails of the road, which is made with a slot to permit the passage of the current collector.

The principal dimensions in the tunnel are: Clear height from top of rail to under side of overhead beam, 2.75 m. (9 ft. ¼ in.), and clear width, 6 m. (19 ft. 8¼ ins.). In order to make a shallow roof, a row of columns was placed in the center, spaced 4 m. (13 ft. 1½ ins.) apart, carrying a line of I-beam stringers, 12 9-16 ins. deep, which again support the cross-beams, 11 13-16 ins. deep, and spaced 1 m. (39⅜ ins.) apart. Between these beams the concrete arches are sprung. Both the longitudinal and transverse beams are rolled from open-hearth steel. The sides and bottom of the tunnel are built in concrete, which admitted of thinner sections and quicker and cheaper construction than would brick. The side walls are made 1 m. (39⅜ ins.) thick, which is more than is really necessary, as they should be considered to be laterally supported by the roof and by the bottom of the tunnel, and not as ordinary retaining walls. In the section where the excavation goes below the ground-water level, cofferdams were used to shut out the water as much as possible, and the excavation was kept dry by pumping under the finished bottom.

The concrete is mixed in small drums, revolving about a horizontal axis, and of ½ cu. m. capacity (0.65 cu. yd.); over each drum is a trough for measuring the exact quantity of stone. All the materials are first mixed dry, and an exact quantity of water is then added; this water is contained in an attached reservoir, and is admitted through the hollow axis of the drum. A couple more revolutions suffice to complete the process. At first four of these machines were in use; later two larger ones, each of about 2 cu. yds. capacity and driven by electric motors, were added.

These concrete mixers were designed by R. Wuensch, of Budapest, the contractor who executed the concrete work.

The following loads were assumed in calculating the roof: First, a four-wheel loaded wagon, weighing 16 tons, with a wheel base of 1½ m. (4 ft. 11 ins.), and second, a 24-ton wagon, with 1.6 m. (5 ft. 3 ins.) wheel base, the latter being used in special streets only.

After completion, sections of this roof were subjected to test loads. First, a concentrated load of 10,000 lbs. was applied on a space 6 ins. square, and then a distributed load of 2,900 lbs. per sq. ft. was applied. Under this latter load the jack arch deflected 0.04 in. at the center, and the beams between which the jack arches are sprung deflected 0.01 in. at the center, with a lateral movement of ⅓ in.

Both these deflections were smaller than those which calculation predicted. The conclusion was therefore warranted that the concrete arches acting together with the beams would show still greater resistance, and the small deflections further indicated that the vibrations of such a roof would be very small indeed.

Fig. 4 shows the car designed for use on the road. Its principal features are the use of side entrances and no communication between different cars of a train. This makes it possible to hang the car body between the trucks at each end, drop the floor down near the rail level, and thus obtain a car with a good high ceiling and abundant air space, and yet with a total height above the rail much less than that of an ordinary car. Taking up the dimensions in detail, the height of the car body above the rail is 2.55 m. (8 ft. 4⅜ ins.). The floor of the car is 400 mm. (15¾ ins.) above the top of the rail, and this leaves a clearance between the top of the car and the tunnel roof of 100 mm. (4 ins.). The car body is 2,400 mm. wide (7 ft. 10½ ins.); the clearances on the sides, between the car and the walls of the tunnel, 200 mm. (8 ins.) each; and the space in the middle, between the cars is 800 mm. (31½ ins.), affording protection to the trackmen and room for depositing material. These clearances are said to be larger than those of the underground road in London.

The cars measure 11 m. (36 ft.) over all, and 9.75 m. (32 ft.) over bodies. There are seats for 30 passengers. (Manhattan Elevated cars of the present standard pattern are 46 ft. long over all, and seat 48 persons.) They have two side doors on each side, with an opening of 37½ ins. for each door. The doors opening toward the center of the track are kept closed, and the space in front of them is utilized by folding seats.

These side doors open into the main body of the car, or the "second-class" compartment. At each end of this is a door leading into two smaller "first-class" compartments for ladies, or men not smoking. At the ends of these latter compartments, or at both extremities of the car, is the motorman's box. These boxes are immediately over the centers of the trucks, between which the passenger compartments are swung. The floors of these compartments are about on a level with the centers of the wheels; this arrangement not only makes it possible to build a very low car, but should ensure unusually easy riding.

The motors on the cars are supplied with current from overhead wires, attached to the roof of the tunnel, and a double system of wiring and current collectors is used, one for the outgoing current and one from the return current. Thus the rails are not used at all to carry current. The potential used is only 300 volts.

The current to operate the line will be supplied from the power station of the existing electric railway, supplemented with a special installment of two 100-HP. dynamos.

The motor is governed automatically, to stop of itself at the end of the route; also the doors are so made that they will not open until the car stops, or the current ceases; and the motors cannot be moved until the doors are closed again. The motors have four-pole fields and are connected directly to the axles, without gearing. The road is operated under a block system, with blocks about 1¼ miles long. The wiring is so arranged that, so long as a train is on a block, the current is cut off from a train entering that block.

Fig. 5 shows a cross-section at one of the stations. Certain changes in the ironwork are introduced in these places, as well as in others where headroom is to be gained. Thus the girders over the platforms are riveted together on a level, and are built of plates and angles, whereby the total depth has been reduced to 22 cm. (8⅝ ins.). At some stations the platforms are broad, 5 m. (16 ft. 4⅞ ins.) wide, and at others only 3 m. (9 ft. 10⅛ ins.) wide. Trains are run of from two to three cars.

The gage is normal, 1,435 mm. (4 ft. 8½ ins.). Iron ties are used, placed about 928 mm. (36⅝ ins.) apart. The rails are 9 m. (29 ft. 6 5-16 ins.) long, and scarfed at the joints, where they are bolted together through angle-bars, fitting closely between the head and base of the rail. The ties have slotted holes, into which the seat-plates and the bolts holding these to the rails can move, so as to adjust the gage before tightening the rails in their final position. The ties, joints and bedplates are on the system designed by Mr. Haarmann, of Osnaburg, Germany, and in considerable use in that country. Their details are shown in Figs. 6 and 7.

Construction of the road was started on Aug. 13, the excavation being carried on in the usual manner for street work. In concreting, the side walls were built first, and then the bottom. The material was deposited in layers and thoroughly rammed. A proportion of 1 Portland cement to 8 Donau gravel was used for the bottom; 1 to 7 for the walls and 1 to 9 for the roof, except where plastering was to be used, in which cases the mixture for the roof was 1 to 11. The drain pipes are finished cement pipes. The cross-beams were put in before the columns and longitudinal beams; then followed the concreting of the roof. No scaffolding

* The above article has been compiled chiefly from information furnished by Mr. A. G. Stradal, Chief Engineer for the Austrian Government, supplemented by drawings and data furnished to Mr. Fr. von Emperger, C. E., of New York city, by Mr. F. A. Schwieger, of Vienna, Chief Engineer of Siemens & Halske, the firm which is building the road, and by Mr. J. Schustler, Chief Engineer for R. Wuensch, of Budapest, the contractor for the concrete work. The translation has been done by Mr. O. J. Marstrand, M. Am. Soc. C. E.

of any kind was used. The concrete was made at one or two central places, and thence conveyed in small cars to points of application. At the present time about 1,000 m. (3,280 ft.) of the road have been completed.

The road is being built by a company organized by the United Surface Co., of Budapest. This company received a franchise from the city for the operation of the road for 90 years, with exemption from taxation for 50 years. There are stringent conditions concerning the method of construction, the quality of material to be used, equipment to be furnished, etc. The estimate of cost made by the Government engineers prior to the beginning of work was 1,000,000 florins per kilometer for the road complete, including stations, equipment, etc. This is equivalent to about $650,000 per mile. It must be remembered, however, that labor is far cheaper there than in America, and the cost of material is also considerably less. Thus it is likely that at prevailing New York prices the same tunnel would cost $1,500,000 per mile.

## DIAGRAM OF COMPARATIVE WEIGHTS OF RAILWAY BRIDGES.

The accompanying diagram is sent us by Mr. H. Breen, consulting bridge engineer of Denver, Col., who prepared it for the purpose of rapidly obtaining the approximate weight of a structure when the weight of a similar structure is known. It may aid in the study of the diagram if we explain that the curves for plate girders have no relation to those for the truss spans, so that we have really two separate diagrams on one sheet. The ordinates over the girder diagram give the percentage of the weight of an 18-ft. span plate girder, and the abscissas on the truss diagram give the percentages of the weight of

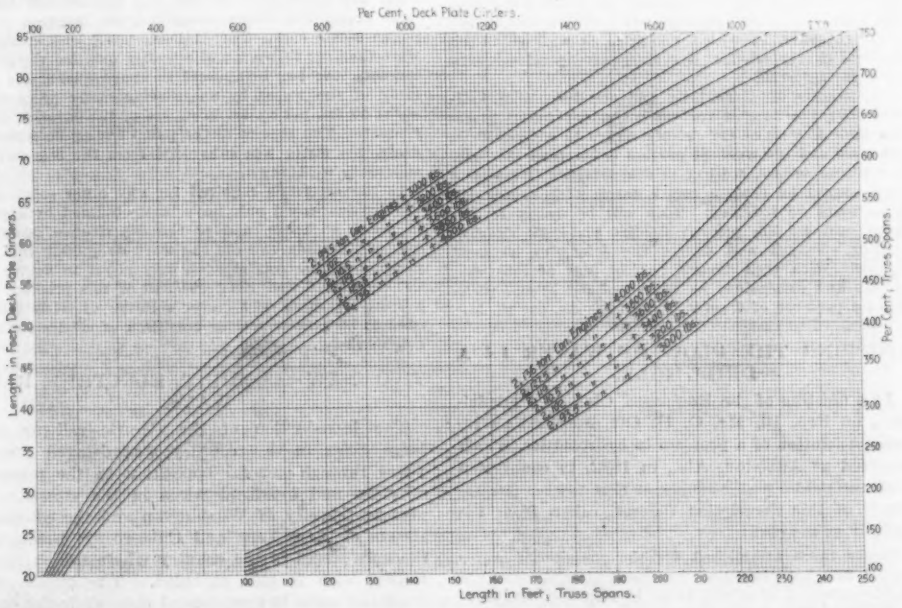



DIAGRAM OF COMPARATIVE WEIGHTS OF RAILWAY BRIDGES. Designed by H. Breen, Denver, Colo.

a truss of 100-ft. span. Concerning the data from which these diagrams are plotted, Mr. Breen writes us:

The curves are based upon a large number of bridges estimated or built during the past six years for engines weighing up to 120 tons, and upon special estimates and comparisons for heavier engines. The estimates were mostly made under two well-known specifications which differ considerably in many particulars, but structures under six specifications in all were used. While actual weights differ considerably under various specifications, the relative weights of spans under any selected specifications are more nearly constant, as might be expected. The errors in actual weight have been between 0 and ± 2½% in nearly all cases, but have in a few cases risen to 4%. For girders, however, when the flange stress varies with the ratio of dead to live load, the diagram may give an excess as high as 7% for the longer spans, and decreasing to the first-mentioned limits at about 50 ft. The majority of specifications are, however, not so written, some constant stress being used for all spans.

The curves are not carried below 20 ft., since short girders or rolled beams are easily calculated, and the additional material which it is advisable to put in them does not make them comparable with longer spans. As 2% or less of the bridges in this country exceed 250 ft., and the quality and amount of steel used in long spans are very variable, no attempt was made to carry the curves beyond that length. For spans 85 to 100 ft., lattice girders are most in favor, but there is little uniformity in design. They should not weigh more per lineal foot than a 100-ft. span.

The panel length for trusses is supposed to lie between 20 and 25 ft. Where impact is specified it should be added to the tonnage of the locomotive, and the corresponding curve used. The floor system of through plate girders is often a very uncertain quantity from lack of depth, but is very easy of calculation and can be added to the weight of a deck girder. The uniform load within the limits of present practice does not cut much of a figure in spans under 250 ft.; but if hair-splitting is indulged in, comparisons may be made with the loads used through the medium of a diagram of equivalent uniform loads.

I think this diagram would prove useful in approximate and preliminary work and in deciding upon a standard load—a subject of much discussion recently—at least so I have found it. It is drawn on as large a scale as convenience demands, and errors are reduced within all practically desirable limits by the division in obtaining ratios.

## TESTS OF LAP-WELDED IRON PIPE.

By P. S. Hildreth.

It is a noteworthy fact that the American manufacturers of lap-welded and mandrel-drawn iron pipe and tubing are rapidly getting possession of many foreign markets. Large orders of pipe from ½ to 4 ins. in diameter have within the last two years been shipped to Russia, Japan, South America, Cuba and South Africa, being used for steam plants, water-works, gas works, mines and artesian wells.

In this connection the following data regarding an order for South America may be found interesting.

The Huanchuca Co., of Pulacayo, Bolivia, S. A., is one of the largest silver-producing mines in the world, and has from time to time placed important orders for machinery and supplies in this country. An order was recently given for 42,640 ft. of 7-in. lap-welded wrought iron pipe, with flanges, gaskets, bolts, nuts and washers complete, the specifications for which, slightly abbreviated, were as follows:

External diameter, 7⅝ ins. Minimum weight, 25 lbs. per lin. ft. To be screw-threaded at both ends, eight threads per inch, with a taper of 1-16 in. in 2½ ins. To be furnished in lengths of 20 ft., or over, 10% being allowed to be under 20 ft. in length, but none under 17 ft. Flanges must be screwed on tight to position with bolt holes at each end in line with each other, and the pipe shall protrude 1-16 in. beyond the flange, as shown on sketch.

Each pipe must be tested with an hydraulic pressure of 600 lbs. per sq. in. on standard gage, and in a manner satisfactory to the inspectors. As a final but purely experimental test, six of the finished pipe will be chosen at random, joined together and submitted to a hydraulic pressure of 3,000 lbs. per sq. in., which shall be maintained for a period of 30 minutes. If the six coupled lengths of pipe do not satisfactorily withstand a pressure of 2,500 lbs. per sq. in. they will not be paid for.

All pipe are to be heated and dipped in an approved mixture of coal tar or asphalt preparation.

Flanges must be made exactly to sketch. They must be made of the best quality of cast iron, turned on parts indicated, and must be a perfect screwed fit on pipe. Bolt holes are to be 1⅛ ins. in diameter, and must correspond. Each pipe is to have one male and one female flange, and there will be furnished 50 extra pairs.

There will be required 6,500 bolts, 1 in. in diameter, 6¼ ins. long from inside of head to point, threaded for a distance of 1½ ins. and provided with hexagonal nuts 1 in. thick and 1⅝ ins. square, and wrought iron washers ⅛ in. thick. The pitch of threads to be Whitworth's standard. The heads of bolts are to be ⅞ in. thick and 1⅝ ins. square. All bolts must be made of the best quality wrought iron, and must withstand a tensile test of from 45,000 to 50,000 lbs. per sq. in. of section. The fracture shall show a tough, even grain.

There will be required 2,500 gaskets, which must be manufactured from the best gutta-percha to a solid ring 8⅞ ins. external diameter and a cross section of ½ in. diameter.

This pipe line was to sustain a pressure not to exceed 350 lbs. per sq. in., but the experimental tests calculated to burst the pipe, were made with the view of securing information which might be of value for contemplated pipe lines where the pressure would be as high as 1,500 lbs. per sq. in. Inasmuch as but few actual bursting tests of pipe have been made in this country, there is considerable of interest in the results.

The pipe was inspected by Messrs. R. W. Hildreth & Co., of New York city, and the following information is from their report as inspecting engineers:

Of the pipe ordered 25,000 ft. with flanges and the 50 extra pairs of flanges were purchased from Morris, Tasker & Co., and made at their Delaware Iron Works, New Castle, Del. The remaining 17,640 ft., with flanges, were ordered from Panconst & Rogers, representing the Reading Iron Co.

The plates used by the Delaware Iron Works were made in about equal quantities by Samuel R. Seyfert and the Pottstown Iron Co. Those used by the Reading Iron Co. were made at their own mills. The pipe at each mill was heated and rolled twice to insure good welds. No pipe was accepted which weighed less than 24 lbs. per ft., and not over 3 or 4% of the accepted pipe ran under 25 lbs. per ft., the specification requirement. The average length of pipe was about 20½ ft., and the weight of a pair of flanges was about 61 lbs.

All pipe made by the Reading Iron Co. was warmed and dipped in coal tar before shipment, as specified. Morris, Tasker & Co., however, asked and received permission to substitute for the coal tar their standard asphalt preparation, which they consider superior to the coal tar for the purpose, although a little more expensive. The results of inquiries into their comparative merits showed that an asphalt mixture is generally preferred by users of water pipe in this country, as it is said to adhere more closely to the iron and scale off less readily.

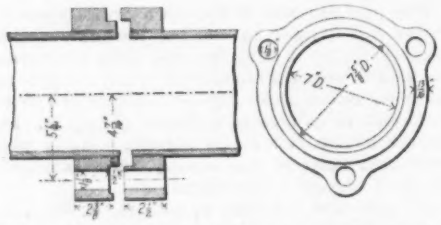
At the Delaware Iron Works ten finished pipe were condemned for light weight, and four flanges were condemned for defects in the castings and replaced. Various minor improvements were made on the facing and threading of pipes and flanges. Every pipe was subjected to a hydraulic pressure of 600 lbs. per sq. in., under which 16 pipe and 3 flanges ruptured or leaked. All pipe requiring new flanges or a flange retapped were tested a second time.

Subsequently six coupled lengths chosen at random were twice subjected to hydraulic pressure until the bursting point of a flange was reached, which occurred at 1,700 and 2,000 lbs. per sq. in., respectively. As in this test the longitudinal pressure was absorbed by the flange bolts only, it was decided that neither the ultimate radial strength of the pipe nor of the flanges had been reached, and therefore a new test was made under such circumstances that radial pressure only should be effective. At the second test the six lengths

of pipe were tied together from end to end by two 3-in. rods, with sleeve nuts for tightening, and the whole line securely blocked and bolted down to prevent buckling. Rupture was obtained four times. At the first trial the second pipe in the line from the pump burst 6 ft. from the middle end at a pressure of 2,400 lbs., leaving a longitudinal rent 18 ins. long opposite the weld. Examination showed the plate to have the same thickness of metal at this point as elsewhere, but to contain a blister about 12 ins. long, which undoubtedly weakened the pipe to some extent. At the second trial a flange cracked at 800 lbs., probably because the line was not screwed up evenly. At the third trial a flange burst with violence at 2,300 lbs. pressure. It was replaced by a new one. At the fourth trial a flange situated at a different joint from the last burst with violence at a pressure of 2,500 lbs., one of the fragments flying 40 ft. or more. All burst flanges in this test and previous ones were female and broke midway between the lugs into three pieces. All fractures showed sound iron of excellent quality. The pressure was gradually applied, and the line of pipe was free from serious vibration. The gaskets used for the tests were those of gutta-percha sent with the pipes, and no difficulty was found in maintaining the joints reasonably tight.

At the works of the Reading Iron Co. one finished pipe was condemned for being short and one for being crooked after final coating; 15 lengths which leaked at the threads under pressure had the defective ends cut off and the threads recut. Two flanges which were cracked in screwing them on were condemned and replaced. Various minor improvements on the facing and threading of pipes were also made here.

Every pipe was subjected to an hydraulic pressure of 1,500 lbs. per sq. in., under which 11 developed flaws and were condemned and replaced. Subsequently



Flange Used on Lap-Welded Iron Pipe at the Huanchuca Mines, Pulacayo, Bolivia.

six lengths chosen at random were coupled together and subjected to an hydraulic pressure of about 2,800 lbs. per sq. in., at which a female flange burst, breaking in three places, each fracture being midway between the lugs. As in this test no provision had been made for taking up the longitudinal pressure, and further as the arrangements were such that the pressure could not be steadily applied, thereby producing much vibration both at the gage and in the pipes, we required another test to be made with suitable provision for taking up the longitudinal pressure and absorbing shocks.

The six lengths of pipe used in the first test were assembled on trucks in the shop, carefully lined up and bolted together. As there was only one gutta-percha gasket intended for this order on hand, it was placed at the joint nearest to the water inlet, and all other joints were fitted with flat rubber gaskets ½ in. wide by ⅛ in. thick, two thicknesses being used at each joint.

Two short pieces of pipe used for similar experiments were bolted to ends of the line and a cap welded over the open ends. At the inlet end a 1½-in. hole was drilled and tapped to admit a 1½-in. pipe; at the other end a small hole was drilled as an air outlet and fitted with a stop-cock. The welded ends of the line butted against two ½-in. plates, about 14 ins. square, which in turn butted against the hub of a heavy gear wheel. The gears had heavy spider webs, which admitted a 2-in. solid wrought iron rod to be passed through, projecting about 18 ins. Three rods were used, each about 135 ft. long, consisting of six pieces welded together. They were upset and threaded at the ends. Heavy collars and washers took up the space between the webs of the gear and the nuts. The nuts were screwed tight, and all tension stress from pressure at the ends of the line was thus provided for. The pump used was a direct-acting, single Knowles pump. This pumped directly into the accumulator, which was weighted with about 25 net tons. At 1,500 lbs. pressure two joints leaked badly; pressure was relieved and more rubber gaskets introduced. At 1,500 lbs. again every thing was tight. At 2,500 lbs. the pressure was held for four or five minutes, while the line was carefully inspected. No joints leaked badly, and only three leaked at all. Among them was that where the gutta-percha gasket was used. The leaks were at the threaded portion between pipes and flanges, and there were no signs of bursting. The pressure was then raised to 3,000 lbs. and held for about two minutes, when the female flange at the joint nearest the water inlet, where the gutta-percha gasket was used, burst in three pieces. The fractures were midway between the lugs, and showed a fine gray iron. The bolts at that joint were bent, but none at other joints showed any stretch.

The bolts and nuts were made by Samuel Hall's Son, New York city, who furnished washers from stock. They were entirely satisfactory, both as regards material and workmanship.

Twelve tensile tests were made on bolts, eight on the round iron and four on finished bolts with nuts, the bolts for testing being made longer only for convenience of testing. The results were as follows:

| Specimen, 1-in. iron or finished bolt. | Elastic limit, lbs. per sq. in. | Ultimate strength, lbs. per sq. in. | Elongation, per cent. in 8 ins. | Reduction of area, per cent. |
|---|---|---|---|---|
| Iron | 30,600 | 51,500 | 21.2 | 38.2 |
| " | 33,710 | 53,430 | 29.4 | 39.2 |
| " | 35,580 | 55,550 | 26.5 | 33.3 |
| " | 36,750 | 55,760 | 25.0 | 33.2 |
| " | 36,750 | 53,360 | 25.5 | 40.3 |
| " | 34,770 | 54,400 | 25.7 | 32.1 |
| " | 31,960 | 50,190 | 18.2 | 31.8 |
| " | 32,760 | 51,540 | 28.5 | 41.1 |
| | | | in 2 ins. | |
| Bolt | 32,480 | 53,790 | 2.2 | .... |
| " | 33,250 | 53,690 | 2.2 | .... |
| " | 30,320 | 48,020 | 1.7 | .... |
| " | 33,570 | 57,220 | 2.5 | .... |

All specimens of round iron showed a fibrous, and all finished bolts a slightly crystalline, fracture. The first three bolts broke in their threaded portion, close to the nut, the last just below the head.

The gaskets were manufactured by the Gutta Percha Mfg. Co., New York city, at their Brooklyn works. They were of pure gutta-percha, treated with about 3% sulphur, and of the specified size and shape.

Sample gaskets were examined from time to time to see that they were of uniform size and appearance. The quality of gutta-percha was tested with nitric and sulphuric acids, ammonia and benzine, for specific gravity and other physical characteristics. It was found to be slightly attacked by dilute nitric acid and dissolved by the benzine, but not attacked by the other reagents, in which respects, as well as in its physical characteristics, it corresponded precisely with pure gutta-percha.

The results of these tests and our inspection indicate that the flanges are weaker under radial pressure than the pipe, the female flange is weaker than the male and the weakest portion is between the lugs. For future orders, we beg to suggest that if a sleeve joint cannot be used, a round flange with five or six ¾-in. bolts be specified. This will be nearly of the same cost as the present flanges and will develop greater strength and enable the joints to be kept tighter. With such flanges, perfect pipe of the same quality and dimensions as those ordered should withstand a pressure of from 2,500 to 3,500 lbs. per sq. in.

## STOPPING THE FLOW OF WATER IN A DRILL-HOLE.

**At a meeting of the Engineers' Club, of Philadelphia, on Feb. 16, Mr. C. H. Ott described an ingenious solution of a problem in hydrostatics, which occurred at Anniston, Ala., in 1882, in connection** with the public water supply of that town. An abstract of this description follows, taken from the bulletin of the club:

Works there established for the purpose of water supply and fire protection for the industrial establishments consisted of a well 10 ft. in diameter, driven to a water-bearing stratum 80 ft. below the surface of the ground, and containing a double-acting, single-cylinder pump, located about 15 ft. above the bottom of the well and worked from the pump-house above. As the quantity of the water required at the time these works were established was not very heavy, the supply from the well in six hours of pumping was sufficient for twelve hours of service, and the engine and pump had sufficient capacity to empty the well within 8 or 10 ft. of the bottom in about 12 hours of continuous working. When it became necessary to repair or examine the pump-cylinder, the water was lowered by pumpage to the greatest possible extent, and then, by means of a steam-jet, the well was kept drained.

As the town grew, the supply from the well became inadequate, and a new well was started about 40 ft. east of the pumping-well. A shaft 6 × 12 ft. was driven to a depth of 120 ft., where a flow of water was had. In order to provide storage for water, and to connect the new shaft with the pumping-well, a timbered drift, 4 × 6 ft., was run to directly beneath and about 40 ft. below the bottom of the pumping-well. The water supply not yet being deemed sufficient, an 8-in. well, cased with pipe, was bored in the new shaft to a depth of 230 ft. below the pump-house floor, and a great flow of water was struck. The drill, in passing through the disintegrated limestone, bored a much larger hole than 8 ins. in diameter, so that large quantities of water passed up outside of the casing. When the depth of 230 ft. was reached, the latter quantity was so great that the water-level in the new shaft could not be lowered and maintained, with the apparatus at hand, to more than about 20 ft. below the pump-house floor. An 8-in. hole was then drilled from the bottom of the pumping-well to the drift below. It was still found impossible, with all of the pumps and jet apparatus available, to lower the water-level in the pumping-well to more than about 25 ft. below the pump-house floor, thus furnishing an ample water supply.

Some months after these arrangements had been finished, a failure occurred in the pump-cylinder under 50 ft. of water, and with the apparatus available it was impossible to lower the water in the well sufficiently to make the necessary repairs. After several expedients had been tried, the following contrivance was devised:

A balloon-shaped bag in dimensions about 3 ft. in diameter and 6 ft. long was made of six plys of bed ticking, roughly quilted into squares. The bag was soaked in linseed oil, and a quantity of rye flour inserted and well shaken around. An inch pipe terminating in a sleeve was inserted in the mouth of the bag, which was then securely wired around the pipe. Sewn to the bottom of the bag was a stout ring, and to this was wired a half pig of iron by a ring bolt inserted into its end. The bag was then wrapped tightly with twine into a cylindrical shape and was lowered into the drill-hole in the pumping-well by means of sections of pipe until the weight struck bottom; by estimation one-half of the bag entering the drift below, the remainder being in the drill-hole. The inch pipe was then attached to the service main, through a stopcock and a pressure-gage attached thereto, and the bag was slowly distended until a pressure of 50 lbs. per sq. in. was reached and maintained. The upper part of the bag swelled out and accommodated itself to the irregularities of the drill-hole, the lower part of the bag swelled out into a bulb shape, the whole resembling an inverted champagne bottle cork. The drainage pump and steam jet were then set to work and speedily emptied the pumping-well, the bag being held in shape during the lowering of the water by an interior water pressure of about 10 lbs. per sq. in. in excess of the exterior water pressure. The repairs to the pump having been readily made, the water was exhausted from the bag and the apparatus withdrawn.

As the materials required for any other solution of the problem could only have been obtained by express in about 48 hours, and as the contrivance described was easily made and did the work so quickly that the pumping-engine was stopped only about 10 hours, Mr. Ott considered that the treatment of this problem was a most ingenious and clever solution of what threatened to be a most serious condition of affairs for that neighborhood.

## TWO NEW CONDUIT ELECTRIC RAILWAYS.

The introduction of the electric railway into large cities in this country was delayed several years through general opposition to the presence of poles and overhead wires in the streets. At present the city of Washington and the congested streets of New York and Chicago are practically the only places in the country where the overhead trolley wire is still excluded. The public has gradually come to comprehend that while the overhead wires and their supporting poles are unsightly, they do not actually constitute the source of danger that was originally supposed. The "deadly trolley car" is deadly more because of the speed at which it runs through the streets than because of the 500-volt current in the wire overhead.

Under these circumstances the incentive to inventors to devise a practicable conduit electric railway is not so great by any means as it was two or three years ago. On the other hand, it is altogether probable that were a conduit electric railway once made thoroughly successful in every way, the street railways operating in many of the largest cities would be compelled to adopt it. Of course it goes without saying that an electric conduit railway must be much more expensive in first cost than a road taking current from an overhead wire. But if capitalists are once thoroughly satisfied of the practical success of a conduit system, the additional cost will not be an insuperable obstacle to its adoption.

The number of electric conduit systems which have been invented is legion; but the systems which have gone so far as the building and operation of

a short experimental line number hardly half a dozen; and only two have thus far been put into regular operation in city streets. The first of these is the often-described conduit railway in Budapest, Hungary; the other is the Love conduit railway, which was operated for some time in Chicago, and is still in operation at Washington.*

We illustrate herewith two new electric conduit

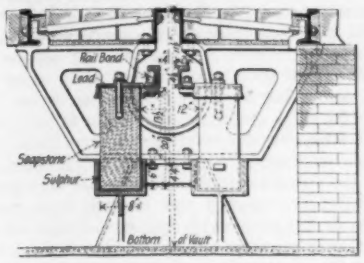



Fig. 1. Electric Railway with Conduit, New York City.

railways which are now being constructed in this country. The first of these is being built by the Metropolitan Street Ry. Co. for its line on 116th St. and Lenox Ave., extending from Manhattan Ave. to the Harlem River, a distance of about two miles. It will form an extension of the Ninth Ave. cable road, and cable conduit yokes are used, the conductors being carried upon insulating supports placed in the manhole vaults, which are 30 ft. apart. The yokes are 5 ft. apart c. to c. The conductors consist of two lines of channel bars, 2¼ x

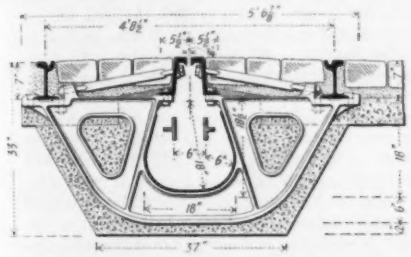


Fig. 2. Electric Railway with Conduit, Washington, D. C.

4½ ins., set back to back, and 4 ins. apart in the clear. The contact shoe carried by the car has two contact pieces forced outward by springs and sliding against the bars, one of which forms the return circuit. The channel bar rests on the lug of an iron cap bolted to the top of a soapstone insulating block. Lead is placed between the cap and the insulator, and the lower end of the insulator is held in sulphur run into a supporting iron socket. The current will be of about 250 to 300 volts potential. The work is being done by the General Electric Co.

A power house and car barn 145 × 550 ft. will be built at 146th St. and Lenox Ave. The power house will be equipped with two cross-compound engines of 1,000 HP. and three of 1,500 HP., all directly connected to the generators, and there will be storing capacity for 250 cars.

At Washington, D. C., the Metropolitan Railway has adopted electric traction in consequence of an act of Congress forbidding the use of horse traction after August, 1895, and as the District Commissioners will not allow overhead wires to be used within the city limits, an electric conduit system, designed by Mr. A. N. Connett, Chief Engineer of the road, was adopted, and is now being constructed on eight miles of the Ninth St. line, while it will be applied later on the F St. line Like the New York road above described, the conduit construction very much resembles that of a cable railway, but the conductors are carried by supports fastened to the top of the conduit, instead of by supports resting on the bottom of the manhole vaults. The conductors are T-irons laid sideways, with the flanges, 4 ins. deep spaced 6 ins. apart in the clear. The horizontal leg of the T is held by the jaws of a heavy nut screwed on to the lower end of a bolt, which has its upper end fitted into a porcelain insulator, which in turn is attached by a flanged sleeve to a casting having its top flush with the track. These suspended supports are placed at intervals of 13 ft. 6 ins., and those for the two bars are staggered 11¾ ins. The feed wires will be carried in terra cotta pipe conduits laid between the tracks, and one of the conductor bars will form the return circuit. The potential will be 500 volts. The power plant will include three cross-compound engines of 400 HP., built by the Providence Steam Engine Co., and direct connected to the three General Electric generators of 300 KW. capacity.

*For description of these and other electrical conduit railways see Eng. News, April 20 and Nov. 2, 1893; Jan. 25, March 8 and April 5, 1894.

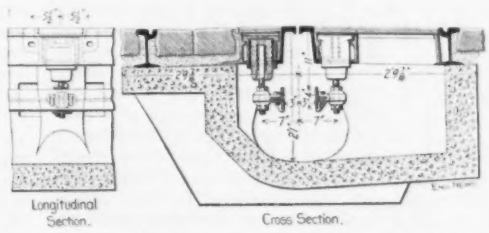



Fig. 3. Conductor and Insulated Supports of the Conduit System at Washington, D. C.

## DAMPPROOF AND FIREPROOF CONSTRUCTION FOR MILLS.

Circulars Nos. 54 and 55 of the Boston Manufacturers' Mutual Fire Insurance Co., relate to the proper construction of basement floors in factories and storehouses and to fire retardent partitions. Mr. Atkinson says, regarding the first, that no system of ventilation seems yet to have been invented which will keep the dark, inaccessible space under a basement floor in a suitable condition to prevent decay. As to the methods of construction, plank floors laid directly upon cement concrete are subject to rapid decay, as the cement is hygroscopic and contains water in the pores, and is a good conductor of heat. Concrete of asphaltum, on the other hand, is a poor conductor of heat; it is antiseptic in its properties, and the floors placed upon it have proved very durable, though the pungent smell of the tar lasts a long while, and may be objectionable in storing certain goods. Floors of this latter class, laid down by the Flynt Building Co., of Palmer, Mass., after 10 years' use have shown the planking as clear and bright as on the day when first put down.

Mr. Atkinson recommends the following for keeping out moisture in cellars where no heavy loads are to be carried, and where dryness is the chief object: Put down first a layer of Rosendale cement from 2 to 3 ins. thick; then cover this surface with two or three moppings of roofing pitch or asphalt, and finally put down a protecting coat, 1 in. thick, of a concrete made of two parts sand to one of Rosendale or Portland cement.

The use of tar concrete is not advisable where heating pipes come near it, and in cement concrete fine crushed granite, in place of sand will give a more durable and better looking surface. For the wood floor on top of the tar concrete, 3-in. square-edge hemlock is recommended, covered with 1 or 1¼-in. maple, laid at right angles to the hemlock and well nailed. The bottom planking should be well seasoned, otherwise dry-rot may set in where any considerable area is covered by machines. Mr. Atkinson gives the following specifications for the two kinds of floors referred to:

Specifications for Tar Concrete Floors.

The floor to be 6 ins. thick, and to be put down as follows: The lower 5 ins. to be of clean, coarse gravel or broken stone, with sufficient fine gravel to nearly fill the voids, thoroughly coated with coal tar and well rammed and rolled into place. On this place a layer 1 in. thick of clean, fine gravel and sand heated and thoroughly coated with a mixture of coal tar and coal tar pitch in the proportion of 1 part pitch to 2 parts tar. This layer to be rolled with a heavy roller and brought to a true and level surface ready to receive the floor plank. No sand or gravel to be used while wet.

A floor of the kind above specified should always be protected by a floor of wood over it, and the plank should be laid and bedded in the top surface while it is warm and before it becomes hard.

For light work, the thickness of the lower layer of concrete may be reduced one or more inches, if upon dry, gravelly or sandy soil.

For storage purposes, where the articles stored are light and trucks are but little used, as in the storage of foundry patterns, the following specification has been found to give a satisfactory floor:

The lower layer being mixed and put down as above specified, the top layer will be of fine gravel and sand, heated and thoroughly mixed with a composition of equal parts of coal tar, coal tar pitch and paving cement, so that each particle of sand and gravel is completely covered with this mixture, using not less than one gallon of the mixture to each cubic foot of heated sand and gravel. This layer should be well rolled with a heavy roller and allowed to harden for several days before being used.

Specification for Cement Concrete Floors.

The floor to be 6 ins. thick and to be put down as follows: The lower layer, 4½ ins. thick, will be composed of 4 parts by measure of clean, coarse gravel or broken stone, 2 parts sand and 1 part of fresh Rosendale cement of some approved brand. The stone or gravel to be broken so that all will pass through a 2-in. ring, and 25% of the whole to be not more than one-half that size; all to be clean and free from loam. All sand to be clean, free from loam and of a sharp grit.

The ingredients to be thoroughly mixed dry and then have just sufficient water added to bring the whole mass to a stiff paste. It shall be thoroughly turned and mixed so that each piece of stone, gravel or sand will be covered with the cementing mixture, and after being put in place, well rammed and rolled till the moisture flushes to the top.

On top of this place a wearing surface 1½ ins. thick of Portland cement concrete mixed in the proportion of 2 parts by measure of fine, clean gravel and sand to 1 part Portland cement. It shall have only sufficient water added to bring the whole mass to a very stiff paste, and then be well rammed and rolled in place and brought to a true and level surface.

If the floor is to be used for washing, dyeing, wet finishing or other similar work, the top layer should be of asphalt instead of the Portland cement concrete specified above. The asphalt to be from ½ in. to 1 in. thick, according to the work to be done.

In connection with cotton-bale storehouses, provided with automatic sprinklers, Mr. Atkinson says that the safest of the ordinary type of buildings one or two stories high are those divided by brick party walls, with each division limited to storing not more than 1,000 bales of cotton. When brick walls are impracticable or too costly, fire retardent or incombustible partitions must be substituted. Probably the most effective partitions, which would not cause undue deflection if placed between posts over ordinary factory beams or girders, are partitions of plaster laid on so-called expanded metal, set in a steel or timber frame, sufficiently strong to resist the heat of a sudden and sharp fire. Such partitions are now used and fully approved of by the Boston Manufacturers' Co. Messrs. Morss & White 75 Cornhill, Boston, represent this expanded metal construction in that vicinity. The same firm has constructed an entire building of this material where a wooden structure was forbidden.

Another approved fire retardent substance, when laid upon 2-in. plank, is Sackett's wall-board, a compound of plaster of Paris and paper in alternate layers, from ¼ in. to ½ in. thick in all. It is readily put up and finished, and is supplied by the Sackett Wall Board Co., of 38 Dey St., New York. Another product, known as the "Salamander," and made of paper and other materials, is also approved. It is in sheets, and can be readily fastened to wooden surfaces. It is furnished by the American Fireproofing Co., of 166 Devonshire St., Boston, Mass.

## RAPID TRANSIT IN LARGE CITIES.

The third "engineering evening" of the season was held at the house of the American Society of Mechanicol Engineers on the evening of March 13. Mr. Geo. L. Morison occupied the chair and the session was opened by a paper by Mr. W. B. Parsons, Chief Engineer of the New York Rapid Transit Commission. To show the antiquity of the rapid transit question in New York. Mr. Parsons read extracts from a pamphlet published anonymously in 1866, but supposed to have been written by Mr. James Lauris, first president of the American Society of Civil Engineers. The pamphlet was dedicated to Mr. William J. McAlpine, and was ad-

dressed to the Senate Commission on Railways. The following extracts are of interest:

A railway project, in some form or other, for the relief of Broadway has been before the state legislature and the New York city government for many years. The first plan was to lay rails in the central portion of the street. This was first seriously proposed by the friends of the Harlem Road. Their efforts, however, to obtain the privilege proved unsuccessful, and in 1832 their tracks were laid in the Bowery, from Prince St. to 14th St. The extensive introduction of omnibuses about this time put the subject to rest for a while, but the great and rapid increase of their number soon seriously interfered with the use of the street for other vehicles, and for pedestrians, and caused the subject of a railway again to be agitated, and numerous plans were suggested. It was not, however, until about 1850 that vigorous and continuous efforts were made to get a double-track surface road in Broadway, and for which the legislature of the state finally granted a charter in 1852. It was strongly opposed by the owners of real estate, and, although sanctioned by the city government, was eventually defeated in the courts.

If the road had been constructed it would not have afforded the relief desired, as from the concentration of the passenger travel the cars would have obstructed and interfered with the crossings and the cartage, and the loading and unloading of goods, to a much greater extent than the omnibuses, the number of which can always be regulated.

Undoubtedly, if the corporators, as the bills passed contemplated, had had the free use of the street for a double-track railway, it would have been immensely profitable; at the same time, the business facilities, not only of Broadway, but of the whole lower portion of the city, would have been materially injured. The next plan was to construct an elevated railway, hanging partly over the sidewalk and partly over the carriageway. This was to be supported on iron pillars, placed near the edge of the sidewalk, 15 to 20 ft. apart, resting on a base 3 ft. in width and spreading out at the top to a width of 5 ft. to carry the railway tracks. There was to be no flooring, nothing but the rails and their supports, stretching from pillar to pillar.

Two methods of propulsion were suggested. By one, the cars were to be drawn by an endless rope, passing over pulleys and operated by steam power or Croton water. By the other, the atmospheric system of propulsion was to be adopted. The trains were to pass up on one side of the street and down on the other. This burlesque on a railway would have been an insufferable nuisance to the travel underneath, and would have been liable to frightful and serious accidents.

Lastly, there is the Patent Elevated Railroad, to be operated by wire ropes or cables attached to drums, driven by steam engines placed beneath the surface of the street at intervals of half a mile. Drawbridges are to be placed at convenient cross streets about one mile apart, in order that loaded wagons of unusual height may pass through. These drawbridges to be opened and shut by the same steam engines that propel the cars. Stairways are to be permitted in the street to reach the cars. It is for such a road as this that the aldermen and council of the city of New York lately passed an ordinance incorporating, substantially, three companies with perpetual rights, authorized to build railways.

After so many plans, and so many years of discussion on the subject, it is not probable that any new plan possessing much originality or merit can be brought forward, provided the object to be accomplished has been thoroughly understood and kept in view.

"These extracts," said Mr. Parsons, "go to show that three decades ago the rapid transit question was an old one in New York city."

Mr. Parsons then gave a brief review of the work which has been done by the present Rapid Transit Commission, followed by an account of experience with rapid transit in European cities, with stereopticon illustrations. The matter was similar to that presented by him in our issue of Oct. 18, 1894, and we therefore take no space for it.

Mr. O. F. Nichols, Chief Engineer of the Brooklyn Elevated R. R., said that he had been surprised to see how favorably the working expenses of the London underground roads compare with those of the Manhattan elevated system in New York. It may be due to the fact that their expenses for maintenance, etc., are so much lighter than they are here. The cost for the movement of trains per ton-mile, however, corresponds very closely here and abroad. This comparison was made not only between two prominent American elevated lines, but comparing these also with the Liverpool Overhead Ry., which is operated by electricity, and all things considered, there was rather a remarkable uniformity in the results as given by the figures. It appears from the figures for the cost of operation of the Manhattan Elevated R. R., in New York, and the Brooklyn Elevated R.R., in Brooklyn, the former having about 35 miles and the latter about 20 miles, that while the operating expenses of the Manhattan road are about 61 cts. per train-mile, those of the Brooklyn were 38.33 cts. Analyzing that still further and getting it approximately at the ton-mile, the result is that the cost on the Manhattan road is 0.615 cts., while that on the Brooklyn road is 0.572 cts., which is practically the same. The expense of motive power on the Manhattan road, including all labor and all fuel and handling of fuel, etc., amounts to 34% of all operating expenses; repairs to rolling stock, about 12%; maintenance of way expenses, 10%; train expenses, 19%; station expenses, 15%; general expenses, about 11%. While the maintenance of way on this road amounts to 10% of all operating expenses, on the Brooklyn line it amounts to 4%, while the motive power on the Brooklyn road represents about 43% instead of 34% of all operating expenses.

Mr. M. N. Forney said that in 1873 he was on a committee of the American Society of Civil Engineers that investigated the subject of rapid transit, and the committee was very much abused for the work which it did, though, as a matter of fact, the present elevated railway substantially adopted the recommendations made by that committee at that time, and in fact the report which was submitted recommending an elevated railway formed to a certain extent the basis of the action which was taken thereafter. The committee spent considerable time in the effort to arrive at some conclusion as to the probable traffic which an elevated railway would carry, and probably that committee was in part responsible for the fact that the elevated roads were built of so light a character, for it did not feel that it could recommend the construction of a railway heavy enough or strong enough to carry heavy locomotives, because it did not think there would be the traffic to necessitate their use. At that time underground roads were discussed, but the conviction arrived at was in favor of elevated roads.

Mr. Morison said that the subject of elevated roads through the blocks has not been discussed as much as it should be. The great difficulty, apparently, in the building of a line through the blocks by a private corporation is not so much the doubt whether it will pay as the fact that it requires an immense outlay of capital, not only enough to build the structure, but to buy the land, and it is much easier to raise $25,000,000 with the expectation of 6% interest than it is to raise $50,000,000 with the expectation if 8% interest. There are limits to the amount which can be raised in one lot. There is another point, which it would be well to bring out. When the elevated railways were first opened they charged 10-ct. fares, except for a little while during the busy hours in the morning and evening. They afterwards changed to 5 cts. at all hours, and the statement is made, and there is good ground for it, that the 5-ct. fare pays exceedingly well as an average, but would not pay for long distance travel. Many of the schemes proposed for elevated railways have been proposed for the purpose of carrying people to the upper end of Manhattan Island and into the annexed district, and it is possible that one of the greatest drawbacks in getting capital to build those lines is the fact that fares are limited to 5 cts.

Mr. Gus. C. Henning said that on Third Ave. the elevated road ran at first up to 66th St., and there was not a house beyond 85th St., except beween Second Ave. and Fourth Ave. On Ninth Ave., when the road got to 59th St., there was not a house in sight, or anything at all to send a single passenger over that road, except a few of the old mansions considerably up beyond 116th St. Harlem was then a city by itself. With those conditions, of course, not much traffic could be expected. When those roads were in operation, the district near the shops began to build up and before the roads were finished there were blocks of houses ready to receive their tenants. On the West Side, on the other hand, there were many blocks without houses along Ninth Ave., but before the Ninth Ave. and the Sixth Ave, roads were finished there were houses ready for tenants all along that line except on the high ground above 59th St., and below 122d St. After those roads had been in operation a few years, tens of thousands of people lived along those lines, simply because the facilities were there. He believed that if those rapid transit roads were extended so as to have through trains for people living further up than 125th St., not serving the people lower down, except at a few points, people instead of moving over to Brooklyn and to New Jersey would stay in the city and the roads would have an immense population to draw on. At present a passenger cannot get a seat before 9 a. m. south of 93d St., and going north in the evening when the heavy traffic takes place there is no seat to be found north of Franklin St. on either road. From the experience on these structures and in the development of the Brooklyn Bridge, he thought very large profits might be expected very shortly after rapid transit roads are built which will have faster trains and at the same time provide additional facilities nearer to the center of the city.

Mr. J. J. R. Croes took up the question as to the difference between 10-ct. and 5-ct. fares. On the Suburban Rapid Transit R. R., which is about four miles long, the fares were 10 cts. and 5 cts. during the first two years, but when the fares were reduced to 5 cts. uniformly the traffic was more than doubled, and the receipts were very much greater, while the expenses were no greater. That was a 5-ct. fare north of the Harlem River. Then a couple of years ago an electric surface road was introduced north of the Harlem River, and the receipts of the Suburban elevated road ran down. This elevated road then passed into the hands of the Manhattan Elevated R. R., which carried the passengers for 5 cts. down to the Harlem River, and then charged another fare of 5 cts. to points south of the Harlem. A bill passed the legislature requiring the Manhattan R. R. to carry passengers over the whole of its line for 5 cts., and at that time the Suburban line's service had run down so that only two-car trains were run all day, but after the passage of the through-fare bill the Suburban road's traffic began to increase and it is now running, morning and evening, five-car trains crowded to their utmost capacity, and the passengers are not all through passengers, but many are suburban passengers. So that by the introduction of the 5-ct. fare from the Harlem River to 176th St., the traffic of the Manhattan R. R. north of the Harlem River has increased very largely and more than was to have been expected. The 5-ct. fare appears to be fixed in the minds of the people of New York, and no greater fare can be charged on any rapid transit road that is going to be operated in New York for any distance whatever. Mr. Croes considered that a rapid transit road properly constructed on proper lines could be made to pay, especially if run in connection with existing lines by a system of transfers.

Mr. Chas. E. Emery said that the question of underground transit has been very much simplified by the rapid strides that have been made in the development of electric traction, and there certainly is no difficulty in doing any work with electricity that can be done with steam. The only question has been the one of economy. Now, it should be borne in mind that not being able as yet to transmute the heat from the coal direct to electricity, we must have boilers and steam engines to generate the current, and we have the losses in the dynamos and motors in addition to those of the engine, but the engines and boilers that can be used in central stations are so very much more economical than those that can be used on the railways as locomotives at the present time, that there is a large chance for overcoming these other deficiencies. There is no question but that electricity will lead in due time, particularly in view of the fact that electrical apparatus is becoming so much reduced in price. About five years ago the Manhattan R. R. had a report made by an electrical expert who went carefully over the whole ground, but the main difficulty then was the enormous cost of changing the plant, and the hopeful feature in electrical traction is that prices are now getting so low that the capital to be expended (particularly on a new road) is not so great as to make electric traction impossible.

Mr. Parsons took exception to Mr. Emery's statement that the day will come when electricity as a motive power will be more economical than steam,

for, as a matter of fact, that day has already come. In regard to the question of the operating expenses of the Manhattan and Brooklyn elevated railways as compared with the three electrically operated rapid transit roads (the Liverpool Overhead, the Intramural of Chicago, and the City & South London), there is no need of comparing the cost of coal in London with the cost of coal in Liverpool, or Chicago, or New York. The following table is computed from official figures of coal consumption and ton-mileage given by each of the roads named:

| | Coal burned per ton-mile. lb. |
|---|---|
| Liverpool Overhead Ry. (electric elevated) | .416 |
| Intramural Ry. (electric elevated) | .495 |
| City & South London Ry. (electric underground) | .604 |
| Manhattan Elevated R. R. (9th Ave.), short trains. | .609 |
| Brooklyn Elevated Ry., short trains | .661 |
| Manhattan Elevated R. R., long trains | .928 |
| Brooklyn Elevated R. R., long trains | .526 |

Analyzing the first five figures, it is really unfair to take into account the Manhattan R. R. figures at all. The Liverpool Overhead Ry. trains weigh 42 tons, the City & South London Ry. trains 44 tons. Taking the Brooklyn Elevated Ry. average train as 63½ tons, the coal consumption on the Liverpool Overhead Ry. is .416 lb., and on the Brooklyn Elevated .661 lb. In other words,the consumption of coal in lbs. per ton per mile is but two-thirds of that where they run steam locomotives. In Liverpool they burn slack of the cheapest grade that they can buy. On the Brooklyn road they burn a high-priced anthracite. So reducing it down to the valuation put in dollars and cents, the difference would be far greater than it is when expressed in lbs. That is also regardless of the fact that the Brooklyn elevated trains weigh half as much again as the Liverpool trains, and the coal consumed per ton per mile does not increase in proportion to the weight of the train. Of course there are certain losses which are entirely independent of the weight of the train,but the results show that the coal consumption per ton per mile on an electric road, is actually considerably less than that of a road run by steam locomotives.

## RECENT PROGRESS IN RAILWAY CAR LIGHTING.

In the series of papers on the "Comparative Merits of Various Systems of Car Lighting," published in this journal in 1891-'92, the number of cars lit by the Pintsch compressed oil gas system in all countries of the world was given as 38,000, of which Germany alone had at that time 21,300. The progress made in the introduction of the system since that time, however, has been very rapid, and a statement recently issued by Julius Pintsch, of Berlin, the inventor of the system, shows that on Jan. 1, 1895, no fewer than 64,000 cars were equipped with this system, in Europe, North and South America, India and Australia. Of this total, 9,000 cars were equipped during 1894.

Mulhall, in his "Dictionary of Statistics," estimated the total passenger rolling stock of the world as 112,500 cars in 1875 and 150,000 in 1885. It is pretty certain that the increase during the decade 1885-1895 has been much less. Probably 170,000 cars would be an ample estimate of the total passenger rolling stock of the world at the present time. If this figure is correct, then 37½% of the cars of the world are now equipped with the Pintsch system of lighting. There are few appliances in connection with railway service which have ever come into such world-wide use. If the present rate of increase continues, it will evidently be but a few years before compressed oil gas will practically drive out all the old-fashioned oil lamp systems of car lighting.

The introduction of oil gas for car lighting has been more rapid in Europe than in this country, largely owing to the greater cost of kerosene abroad, and the opposition to its use on railway cars on the ground of danger. Nevertheless rapid progress is being made by compressed oil gas in the United States. The Safety Car Heating & Lighting Co., of New York city, has recently furnished us a statement showing the companies which had cars equipped with the Pintsch system on Jan. 1, 1895, with the number of cars so equipped, and the miles of railway operated by each company.

The total number of cars equipped with the Pintsch light in the United States and Canada, as given in this statement is 6.573, operated on nearly 100,000 miles of road. Of these cars, 1,059 are on elevated, cable or electric railways, and 1,122 are Pullman or Wagner cars, leaving 4,392 as the number of ordinary passenger coaches equipped.

Concerning these 4,392 day coaches which have been fitted with improved lights, investigation appears to show that the great bulk of them are comprised in two classes—cars used in suburban traffic and the best class of coaches used in fast express trains. Railway managers, during the close times of the past few years, have been reluctant to spend money for the improvement of passenger cars used in ordinary traffic, and only the force of competition and the necessity of creating traffic by fostering its growth have compelled the equipment of suburban cars and first-class day coaches with improved lights.

Indications are not wanting, however, that this policy will have to be extended in the near future. The number of gas-lighted cars now in use on steam railways and the great improvement in the lighting of street railway cars which the general introduction of the trolley has brought about have educated the travelling public in the matter of car lighting. Grumbles and complaints are now common concerning the lighting of cars which would have been considered admirably lighted a dozen years ago. The competition of electric railways with the steam roads for local traffic can certainly not be met unless passengers can read their evening papers as comfortably in the cars of the steam roads as in the brilliantly lighted electric cars.

The public dissatisfaction with dim oil lamps has been evidenced of late in proposals for legislation. Bills have recently been introduced in both houses of the New York legislature requiring the Manhattan Elevated Ry. "to equip all passenger cars with the most approved lighting system now in use," and prohibiting the use of oil lamps after June 1 under a penalty of $50 per car per day for each car. The bill will doubtless go to the legislative waste-basket; but it is an indication of the way the wind is blowing. It is fair to say that the Manhattan Ry. doubtless deserves the distinction of injuring the eyesight of a larger number of persons daily by poorly lighted cars than any other railway in this country, if not in the world.

It is a fact worthy of note that of the cars equipped with Pintsch gas by the Safety Car Heating & Lighting Co.—some 6,600 to date—about 4,600 have been put in service during the past 3½ years, during which time retrenchment in railway expenditures has been carried to an extent never before known. Had former prosperous times prevailed, there can be little doubt that progress in the introduction of improved lights would have been even more rapid.

Electric lighting for railway cars may be said on the whole to retain the position it held a half dozen years ago. While it has gained ground in some respects, it has lost in others. The reduction in the cost of electrical apparatus has considerably reduced the first cost of equipping cars by this system, but the system chiefly used in this country (the combined dynamo and storage battery system) is badly hampered by the weight of the machinery required, the cost of attendance, and the fact that all the cars of the train depend on the baggage car for their supply of current, save a supply in storage batteries on each car sufficient for a few hours only. For these reasons this system of car lighting appears to be on the decrease.

It has become increasingly evident during the past few years that if electric car lighting is ever to be anything more than an expensive advertisement for the passenger department, it must be so arranged that each car will be independent of every other, and inventors have therefore turned their attention in this direction. One scheme, on which we believe two or three companies are at work, is to equip each car with a miniature dynamo, driven from the axle. Storage cells under the floor of the car are relied on for current while the car is standing still, and are recharged by the surplus current while the car is running. The endeavor is to make such a system automatic as far as possible, and thus do away with the constant attendance, which has been an important factor in the operating cost of electric car-lighting systems thus far tried.

Another scheme for accomplishing the same end is to return to the first plan by which cars were ever lighted by electricity, the storage battery system. The improvements which have been made in storage batteries and in electrical equipment generally since the first Pennsylvania parlor cars were lit by storage batteries, make the system much more feasible than it was at its first introduction. On the other hand, the necessity for removing the batteries from the car for recharging seems to be a permanent handicap to any extended use of this system. It has been adopted, however, on the Chesapeake & Ohio limited express trains in place of the combined dynamo and storage battery system, formerly used on these trains, and is claimed to be giving satisfactory results. Details of the experience on the Chesapeake & Ohio were given in our issue of Dec. 20, 1894.

## POWER DEVELOPMENT FROM A MINE DRAINAGE TUNNEL.

The extensive works undertaken for draining the Ontario mine by means of a powerful pumping plant, and later by a drainage tunnel extending from the bottom of the deepest shaft to a gulch at the side of the range in which the mine is worked, were fully described and illustrated in our issue of Nov. 29 1894,and we have recently received from Mr. W. P. Hardesty, C. E., of Salt Lake City, some particulars as to the extension of the tunnel and the development of the water power.

The drainage tunnel, which is at the 1,500-ft. level, is being extended from shaft No. 2 to shaft No. 3, which is at present down only to the 1,000-ft. level. The tunnel extension will be completed long before the shaft is sunk down to reach it; but meanwhile it will serve to drain a large amount of ground preparatory to working it. The work is being done by the same organization and the same methods as before, except that the excavated material is now hoisted through No. 2 shaft (which contains the great Cornish pumping engine), instead of being hauled to the east portal of the tunnel. Mr. John H. Keetly is the foreman of construction, as before.

An interesting feature of the work is that the great flow of water from the tunnel is being utilized for power purposes. The ditch and flume through which the water was conducted from the end of the tunnel have been extended about 1,200 ft. on a light grade, and from this point there is a fall of about 125 ft. in a distance of 500 ft. to the power house, 30 × 40 ft., at the bottom of the McEwen gulch. From a wooden tank at the end of the ditch a riveted iron pipe of 30, 29 and 28 ins. diameter leads down to the basement of the power house, where it branches out into two 20-in. pipes for driving two 36-in. Pelton double-nozzle special water-wheels, having a combined capacity of 90 HP. Only one wheel will be used at present. The hydraulic plant was supplied by the Pelton Water Wheel Co., of San Francisco.

In the story above the basement is a monocyclic dynamo, with a capacity for 816 incandescent lights of 16 c. p., which, together with all the electric plant, wiring, etc., was furnished by the General Electric Co. The alternating system is used, with a pressure of 2,200 volts. There are six miles of three-line wire (No. 3 wire) used for transmission, this being about the greatest distance, and the line runs first to Park City and thence to the Ontario and Daly mines. At Park City the Marsac and Ontario ore reduction mills and Ascheim's store are supplied with light. Both the mines, with their boarding and sleeping houses, offices, etc., are also lighted. It is intended to supply power also, and two 10-HP. motors will soon be placed, one at the machine shop of the Ontario mill, and the other at the machine shop of the mine, while a 25-HP. motor will be used at the sawmill at No. 3 shaft of this mine.

With the completion of the drainage tunnel and the stoppage of pumping, the operation of the 6-ft. Pelton wheel at the Marsac mill, which depended for its power on water from the old No. 1 drainage tunnel, had to be stopped, as the water to this tunnel had mostly been pumped before. This wheel and its dynamo were therefore taken out, and current is supplied from the new system.

# ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

*Published Weekly at Tribune Building, New York.*
*Entered at the Post Office, New York, as Second Class Matter.*

VOL. XXXIII. THURSDAY, MARCH 21, 1895.

D. McN. STAUFFER, A. M. WELLINGTON.....EDITORS.
GEO. H. FROST.....BUSINESS MANAGER.
F. P. BURT.....ASSISTANT MANAGER.
CHAS. W. BAKER, E. E. R. TRATMAN, M. N. BAKER,.....ASSOCIATE EDITORS.
A. B. GILBERT.....EDITOR CONSTRUCTION NEWS.
CHAS. W. REINHARDT.....CHIEF DRAFTSMAN.

CHICAGO OFFICE: 1,636 The Monadnock.
CHAS. S. HILL.....RESIDENT EDITOR
F. A. PECKHAM.....ADVERTISING MANAGER

EUROPEAN AGENCIES:
KEGAN PAUL, TRENCH, TRUEBNER & Co. (Limited), Paternoster House, Charing Cross Road, London, Eng.
SAMPSON LOW, MARSTON & Co. (Limited), St. Dunstan's House Fetter Lane, London, Eng.

*SUBSCRIPTION RATES: United States, Canada and Mexico, One Year, $5.00; 6 months, $2.50; 2 months, $1.00; single copies, 15 cents. To all other countries in the Postal Union, add $3.08 per annum (4 cents per number) to above prices for postage. No club rates allowed. Mailing addresses may be changed at will by sending both old and new address. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.*

*The date when the subscription expires is on the address label on each paper: the change of this to a subsequent date is the only receipt sent, unless by special request.*

*ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 22. Rates for standing advertisements sent on request. Changes of advertisements must in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.*


A Boston correspondent reminds us that, in crediting the Brooklyn Wa-ca-ma-ha-ga Club with being the first engineering organization in the United States, we should not forget or ignore the claims of the "Hub of the Universe." Our correspondent goes on to state that the Boston Society of Civil Engineers was organized in 1848, and the first regular meeting was held on July 3, 1848. Among the Directors then chosen was James Laurie, later the first President of the American Society of Civil Engineers, and E. S. Chesbrough and James B. Francis, both Presidents of the American Society of Civil Engineers, were present at the early meetings. It is further said that the constitution of the Boston Society of Civil Engineers served as a model for that of the American Society of Civil Engineers, founded in 1852, and much of the phraseology of the old was repeated in the newer document. As the Boston Society was organized nearly 47 years ago, and the Wa-ca-ma-ha-ga can only date back about 44 years, to the best of our information, we bow to the "Hub" and make the correction here recorded. Both organizations have honorable records; and while only one has survived, neither should be forgotten in discussing the early history of engineering societies in the United States.

On another page of this issue is described a novel apparatus for cooling hot water in large quantities, which is of especial interest in view of its applicability to situations where it is desired to attach a condenser to a steam power plant, but the supply of condensing water is limited. The apparatus is simply a contrivance for spreading the cooling water out, so as to expose a very large amount of surface to cooling air currents, and is notable for its cheapness and efficiency. The especial apparatus described was not used in connection with a power plant; but as a matter of interest we have computed the amount of cooling done by it, and find that, making reasonable assumptions for quantities not stated by the author, the apparatus described would be sufficient to cool the condensing water from an engine of over 1,000 HP. When it is added that the apparatus occupies a space only 20 ft. high, 16 ft. long and 8 ft. broad, and costs, all told, only about $320, its efficiency becomes evident.

The gain in fuel economy by condensing is well known, and it is especially important in sections where fuel is expensive, as on the Pacific coast, for example. With such a simple and cheap means of cooling condensing water available as that which is described herewith, many establishments would find it economy to install condensers, which are now debarred from doing so on account of lack of water.

The Pennsylvania Railroad Co., in the last report of President Roberts, calls the attention of its stockholders to the large amounts expended recently in elevating the roadway of the United Railroads of New Jersey Division, at Elizabeth particularly, and also in the neighborhood of Philadelphia, where all grade crossings are being abolished. Mr. Roberts advises the suspension of work of this character until definite legislation can be had to prevent the increase of highway crossings at grade, especially crossings by electric railways. This is one of the points referred to by this journal recently as needing prompt attention by our law-making bodies. Electric railways are extending rapidly over the country, practically occupying the place of light railways operated by steam for the transport of freight as well as passengers. They are novelties as yet, and our legislatures are continually granting privileges to such corporations that in the near future may prove sources of serious public annoyance and danger, unless some closer attention than now is paid to the subject of grade crossings and protection at such crossings. Electric railways, as a means of communication between towns, have come to stay, and they well solve the cheap, light railway problem. But, as President Roberts says in his report, it does not seem equitable that steam railways should be compelled to make large outlays in abolishing grade crossings, when the object in view—the safety of the general public—is being practically defeated by the continued opening of new highways, and by the privileges thoughtlessly granted to electric lines to use these same highways at grade. The danger to life may be somewhat less in the latter case, but we have convincing proof in the daily record of trolley accidents that it does exist, and as this record grows with the extension of electric transit, the aggregate may soon equal the proportions of those recorded for the steam lines a few years ago. As these accidents compelled grade crossing legislation against the steam railways, it would seem to be only a question of a short time when similar action will be absolutely necessary in the case of the electric lines. In fact, this action is already being taken in the larger cities and towns, and it would seem wise and economical to apply the remedy to suburban lines while the aggregate expenditure upon them is yet comparatively small.

While the effect of the competition of electric roads with steam railways has been felt for some time in the neighborhood of the larger cities, this competition is now seriously troubling trunk railways by paralleling their lines between stations. The direct loss of traffic resulting has caused the New York, New Haven & Hartford and the New York & New England railway companies to appear before the Connecticut legislature with a vigorous protest against the further granting of charters to electric roads paralleling steam railways. The railway companies presented figures showing their losses in the last three months at various stations affected by electric competition; and these figures are chiefly interesting as proving that the reduction in receipts from this cause far exceeds all previous estimates. To take a few examples from many, it is found that between Norwalk and Rowayton there was a loss of 50 per cent. of all the business, and between Bridgeport and Southport there was a loss of 80 per cent. But between Meriden and Yalesville, Waterbury and Naugatuck and Ansonia and Birmingham, as much as 90 per cent. of all business abandoned the steam route for the electric lines. The average loss of business by the steam railways directly due to the competition of electric lines seems to considerably exceed 50 per cent. of the entire business.

How to meet this competition is the serious problem now being carefully studied by a number of the steam railways. The fact is that in the Connecticut cases referred to the electric lines are preferred simply because they give a cheaper and more convenient service at shorter intervals of time than can possibly be afforded by any first-class steam railway, with its heavy trains, expensive roadway, stations and line equipment, and the comparatively excessive cost of operation. These are conditions that the steam lines cannot ignore, and we do not see that appeals to the legislature for prohibitory measures against possible competition from electric lines will help them. It would not be just legislation to the people living along the railways, if it could be enforced by corporation influence. These people have a right to the best service possible at the lowest rate; and if they find this service in the electric lines, electric lines they should and will have. The steam roads will, however, for a time yet at least, defy competition on the longer distance travel; and the eventual outcome of the present trouble may result in the division of the traffic, the steam railways taking long-distance passenger travel and heavy freight, and electric railways hauling local pasenger traffic and light freight. One of the New England lines is already testing this solution of the problem by buying up several competing electric roads; and as the issue must soon be squarely faced by all steam roads subject to similar competition, the outcome will be awaited with very considerable interest. A number of electric projects are only waiting for better times financially to practically parallel the Pennsylvania railway system from New York to Harrisburg and to Washington, and when these lines are once in operation a struggle will be inaugurated that may result in completely changing our whole system of transportation.

In the proposed consolidation of the Astor, Lenox and Tilden libraries, the city of New York seems to be about to obtain what it has long needed, a great and well-administered public library, with a handsome income from a permanent endowment fund. As an entirely new institution is proposed, with a new classification of contents, under more liberal rules of administration, it would be well if engineers took some trouble to see that the needs of their profession were not overlooked. While nearly every public library contains the more common works of reference upon engineering topics, anything like a comprehensive and well-handled engineering reference library does not yet exist in the United States. Even in our engineering societies and schools of engineering the records preserved of the many and important engineering works performed in this country during the last fifty years are so meager in quantity that those responsible should blush for the opportunities lost. Money, room and intelligent supervision are all needed for the founding and successful operation of a library of this kind; but when the material value of a complete technical library to the whole people is considered, it is worth all of these requisites.

Were engineers of all branches, mechanical, electrical, civil, military and mining, to unite in properly presenting the matter to the directors of the new public library, when organized, a fair start could doubtless be made toward a much-desired end. In the several libraries of these technical bodies in this city many useful and valuable books are duplicated; many more of even greater value are missing entirely. No one library can aspire to the rank of a library of reference anywhere within the proper meaning of that term. Why not add all these scattered books that are not duplicates to those upon kindred subjects already owned by the libraries to be consolidated? Even at the start such a library would be better than any one now existing, and there would be every inducement to constantly add to its treasures. Removed as such a library would be from the influence of any rivalry among societies; conducted upon well-established and systematic methods by independent experts, and in a position directly to attract contributions of all literature that has to do with engineering in the United States, it would seemingly have many advantages over any other available form of technical library.

With the means now at their disposal, and without a well-organized staff or well-defined purpose, the existing engineering libraries practically neglect

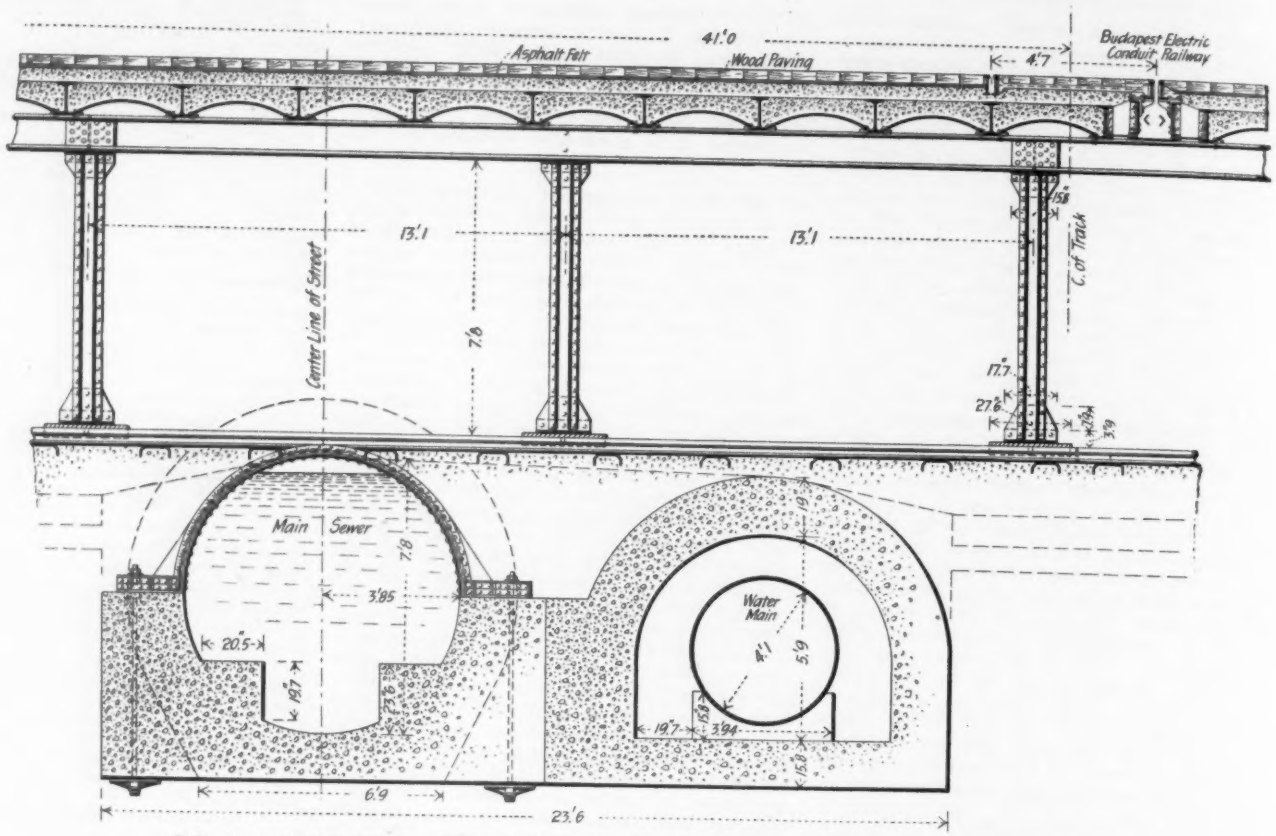



FIG. 3. LONGITUDINAL SEOTION AT RING ST. (CROSSING OF SEWER AND WATER MAIN).

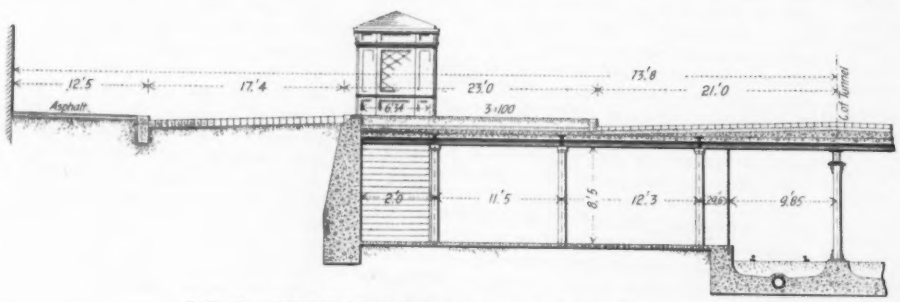



FIG. 5. CROSS-SECTION OF RAILWAY AT STATION.

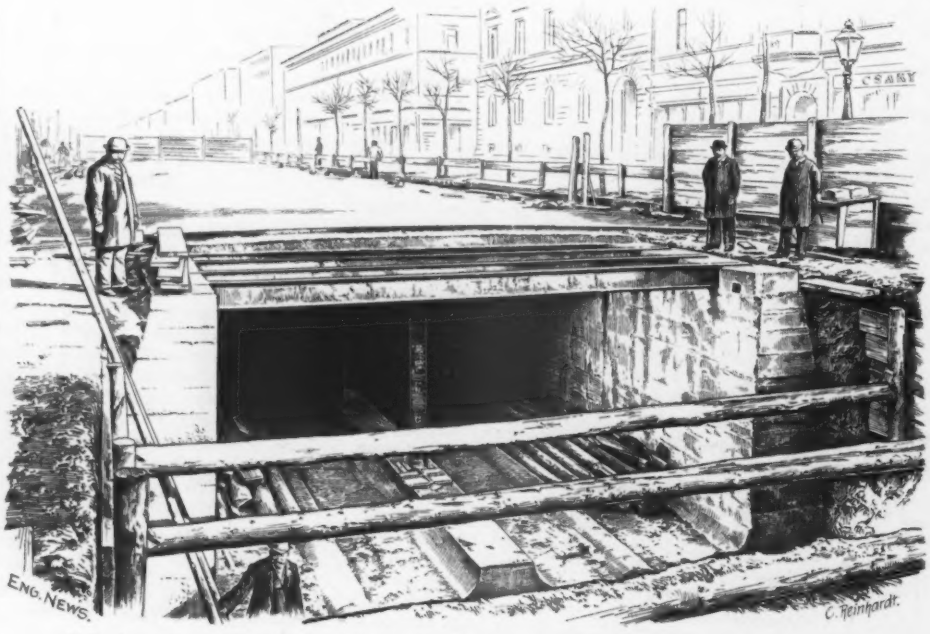



FIG. 8. VIEW ON ANDRASSY ST, SHOWING TUNNEL UNDER CONSTRUCTION.

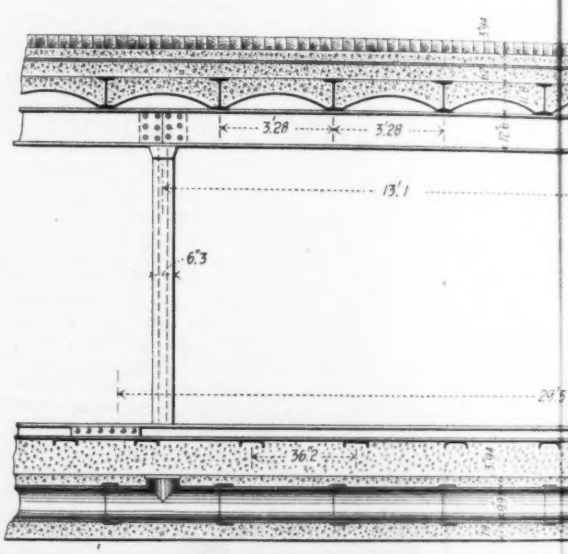



FIG. 2. LONGITUDINAL SECTION

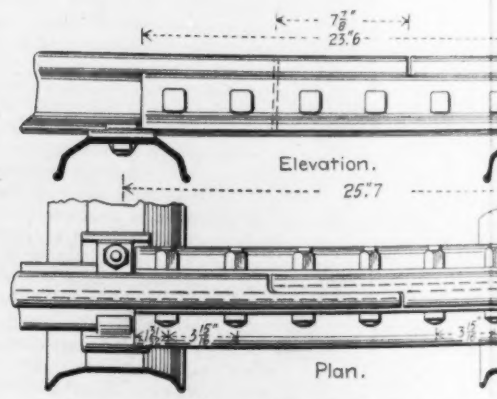
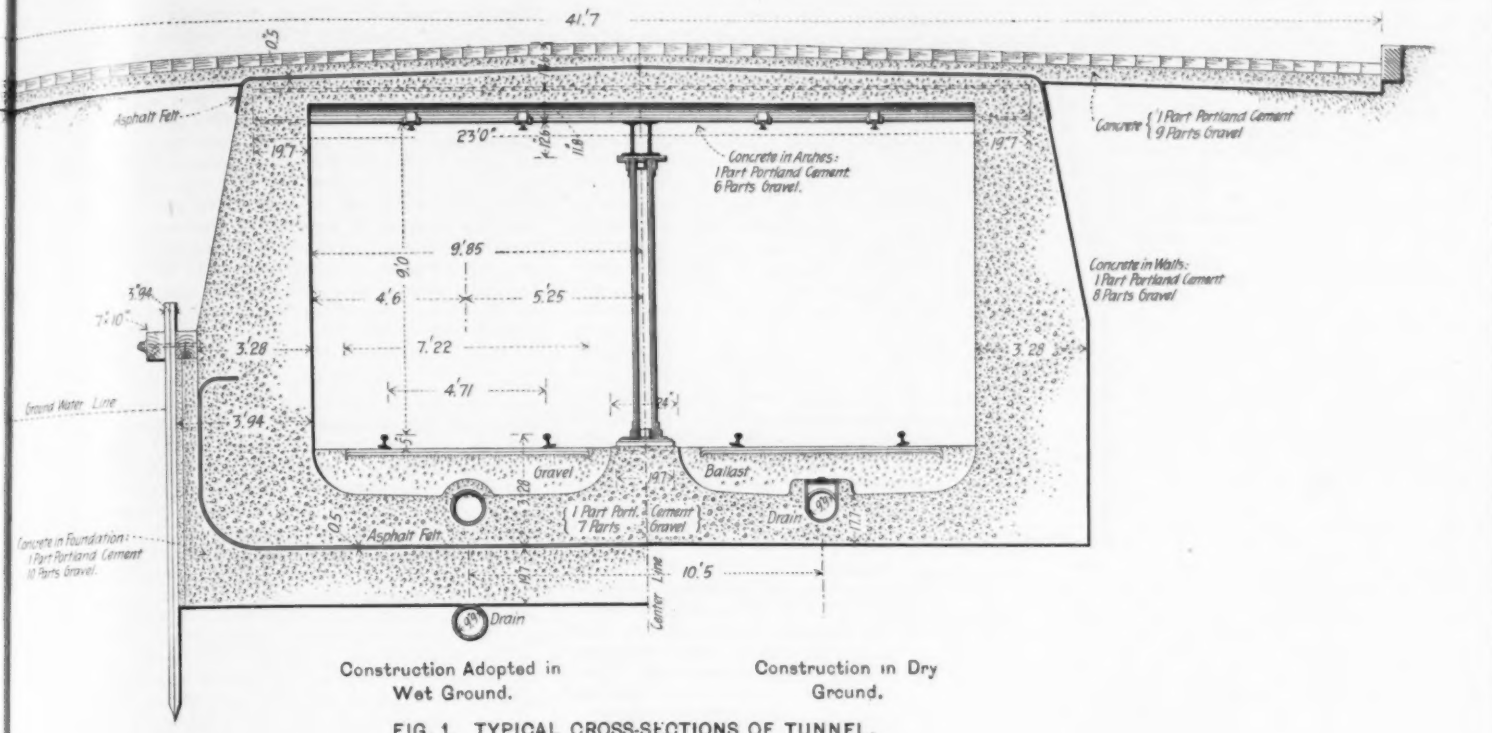



FIG. 7. RAIL JOINT ON BUDAPES

THE NEW ELECTRIC UNDERGROUND

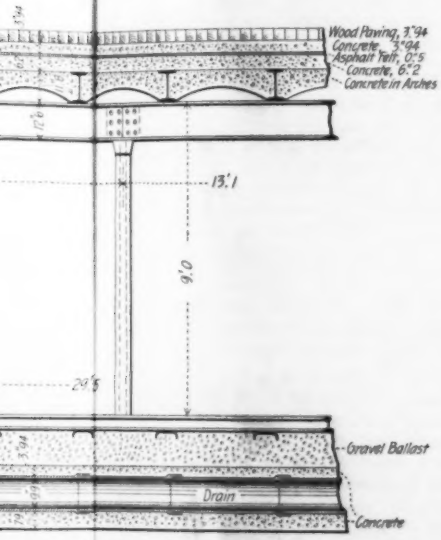
Siemens & Halske, Berlin, Contractors for Electrical Equipment.



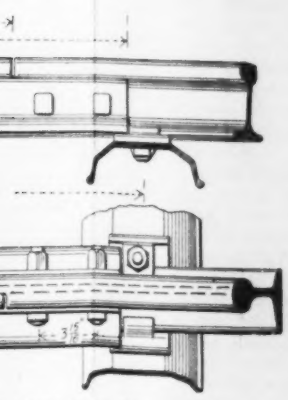

Construction Adopted in Wet Ground.

Construction in Dry Ground.

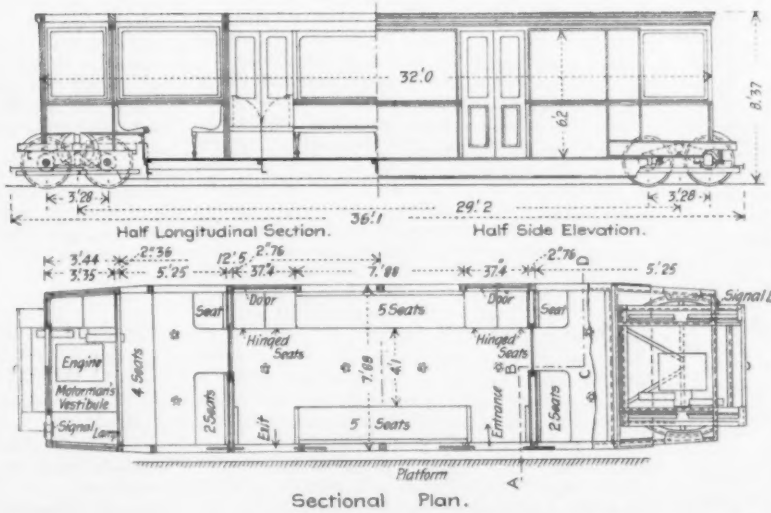
FIG. 1. TYPICAL CROSS-SECTIONS OF TUNNEL.




L SECTION OF TUNNEL.



N BUDAPEST RY.



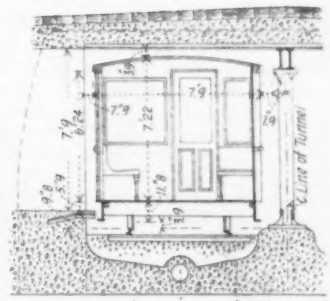




FIG. 4. STANDARD CAR FOR BUDAPEST RY.

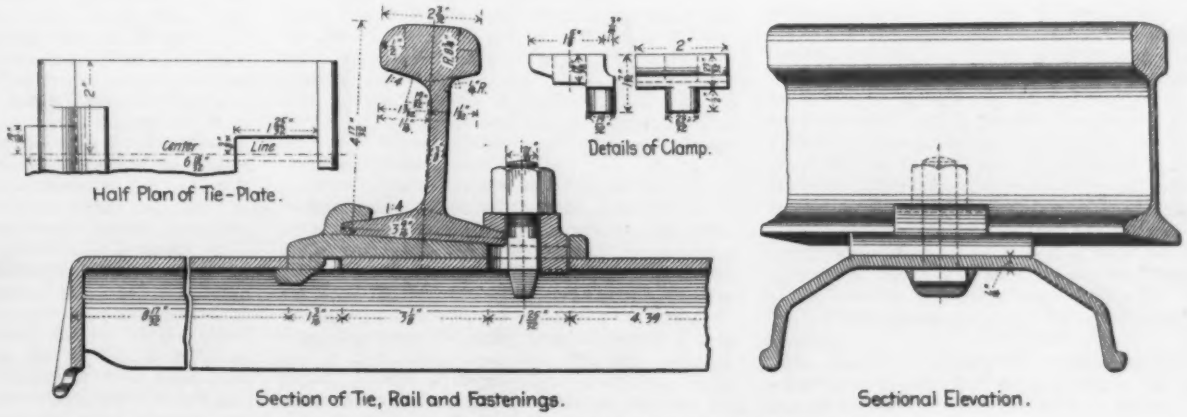



FIG. 6. DETAILS OF TRACK FOR BUDAPEST RY.

ROUND RAILWAY IN BUDAPEST, HUNGARY.

R. Wuensch, Budapest, Contractor for Concrete Work.

the vast amount of pamphlet literature upon engineering subjects annually published; though, as a rule, this class of matter costs little more at the time of issue than the trouble of collecting and filing it. Yet these annual reports and transient pamphlets often contain the only records of engineering works or projects of great importance, and embody information that would be invaluable at times for reference. As every one knows who has had occasion to seek publications of this kind, they are the first to disappear in the maw of the paper-mill, and it is of the greatest importance that some systematic effort should be made to preserve them, to classify them and to make them accessible to those interested. This should be one province of the engineering department of the new public library, could such a department be instituted.

In thus advancing the claims of engineers to a special department, it is assumed that any great public library, such as the Metropolis of the United States should possess, will equally recognize the needs of all trades and professions. And furthermore, the systematic collection and classification of the literature especially referred to here are by no means a matter interesting and valuable to engineers alone. Engineering is a very broad science, and, more than any other, has to do with the daily life, convenience and material progress of the whole nation. Its literature is of value to the lawyer, the capitalist, the projector and inventor; and without it any one interested in our future civilization and an advance upon older methods would be seriously handicapped in his efforts. New York city is the engineering headquarters of the whole country, for it is the money center, furnishing the means by which engineering projects are materialized; and it is eminently fitting that in this city should be found the most complete and best administered engineering library. As branch libraries are included in the present plan of consolidation, the downtown branch seems to be the proper place for the scientific reference library, because it would be consulted chiefly by men whose offices are located in the downtown districts, far removed from Morningside Park or even Bryant Square. We believe that a special library of this character, located in the busy part of the city, well equipped and properly managed, would present so many advantages to those who have grown rich by industrial enterprises, that it would not be difficult to raise all the means necessary for the end in view.

## UNDERGROUND OR ELEVATED CONSTRUCTION FOR THE NEW YORK RAPID TRANSIT RAILWAY.

In our issue of Feb. 7 we discussed some of the questions of interest in connection with the engineers' plans for the New York Rapid Transit Railway. At that time the general plan of construction to be adopted was still undecided and we therefore postponed discussion of that phase of the subject. As announced in our last issue, the Commission has finally decided to adhere to the original plan of four tracks on a level for the Broadway line, widening the road, however, to permit a greater clearance between the tracks, in accordance with the unanimous recommendations of all the engineers who have been consulted. It has also been decided to raise the road so that its roof will be just below the street surface and to dispose of the pipes, electric subways, etc., now buried beneath the street surface in galleries underneath or at the sides of the railway. We explained last week the benefit which will result from this change of plan, and will only repeat our summary by saying that the disposal of the present underground pipes in accessible subway chambers seems certain to be worth all it will cost. Further, the raising of the level of the excavation to a point above the level of building foundations and for the most part also above the ground water level, finally disposes of the often-urged claim that damage will be done to buildings along the line by the construction of the road, eliminates the risk and danger which would attend any attempt to tunnel beneath the street surface, and greatly decreases the volume of excavation.

Now that this plan of construction has been adopted, it seems worth while to take up a question which is giving a great deal of concern to many people, some of them wise and some of them otherwise, and which is being discussed somewhat in public and a good deal in private. That question is whether it is not a mistake after all to put the rapid transit railway underground, and whether more elevated railways or an addition to the Manhattan Elevated tracks is not the best thing to be done in order to give the city the rapid transit facilities desired. It is true that the underground plan has been approved by the legislature, the courts and the voters of the city, that the city's credit is pledged to the amount of $50,000,000 to furnish funds for its construction, and that the Commission is steadily proceeding toward the preparation of the detail plans and specifications preparatory to the award of the contract for the work, as required by the law. At the same time the ups and downs of politics are uncertain, and the fact that the Commission finds it necessary to ask for further legislation to facilitate its work may be taken advantage of by the many powerful enemies of the underground enterprise to hamper the work by reopening the question of elevated vs. underground lines.

It is, therefore, well worth while to discuss the claims which are being so strongly urged by some prominent makers of iron and steel, some owners of Manhattan Ry. stock, and lastly by some intelligent men, including a few members of the engineering profession, who are doubtless honest in their conviction that the underground rapid transit road is a mistake.

The trump card of these opponents of the underground road is that it will cost such a great sum as to be financially impracticable, whereas an elevated roadway, at present low prices of iron and steel, can be built at very moderate cost. We hear this difference in the cost of the elevated and underground systems paraded as if it were a new discovery, and the changes are rung upon it to an endless degree.

Now, no one—or rather no competent engineer—would dream of denying that an elevated structure to carry a given traffic could be built more cheaply, and a good deal more cheaply, than a road underground. What the advocates of the underground road say is that such an underground road as can be built in New York city at the present day is enough better than an elevated road as to be worth its extra cost, and further, that the traffic which such a road can command will be sufficient to warrant its extra cost.

It is not always realized, as it should be in considering this question, that in New York city the daily flow of traffic may be concentrated, along central or axial lines, as it is in no a central or axial line as it can be in no other great city in the world. This is due, first, to the long, narrow form of Manhattan Island; second, to the fact that it is a mercantile city rather than a manufacturing city, and that its great office-building district and its chief mercantile district are located near one end of the island, while the residence district occupies the central portion and opposite extremity. In a city built upon a broad plain, like Chicago or Philadelphia for example, there is no such concentration of traffic along axial lines. The traffic lines radiate from the center and the amount of traffic rapidly falls off as the distance from the center increases. Experience in Chicago and Brooklyn has pretty clearly shown that the concentration of traffic in those cities is barely sufficient,or is insufficient,to support elevated railways, in competition with surface railways operated by electricity or cable.

Again, passenger traffic in great cities, like suburban traffic, is difficult to make profitable on account of its concentration in the morning and evening hours. The amount of rolling stock and operating force required and the capacity of the whole plant are fixed by the maximum traffic in one direction during near two hours of the day, and during the remaining hours the traffic falls off so that a large portion of the plant stands idle. The case is similar, indeed, to that of electric lighting stations, where the capacity is fixed by the maximum load, but for some 20 hours of the day only a quarter or less of the engine and dynamo capacity is required.

But New York is peculiarly favored in having its retail district located some three miles from its office district, and further, in having a fringe of manufactories around its water front and scattered through a large part of its area. Thus, while in general the rush of traffic is down town in the hours from 6 to 9, and up town from 5 to 8, there is a large traffic movement in the reverse direction and there is a very considerable traffic (which would be enormously increased if real rapid transit were furnished) during the other hours of the day.

It will be conceded, of course, that the rapid transit railway ought not to be built underground unless it can secure traffic enough to support it, and by supporting it we mean pay its operating expenses, the interest on the money loaned for its construction and a fair profit to the operating company. As for the operating expenses, there is no apparent reason why they should be greater on an underground road than on an elevated road. The extra cost of lighting and ventilating the former may fairly offset the cost of maintenance of the structure of the latter, an item, which on the Manhattan Ry. amounts to 10% of the total operating expenses.

The interest on the money invested, which is an uncertain quantity in most enterprises until the bonds are floated, is reduced in this case by the fact that the city's credit is back of the enterprise, to 3½ per cent. (plus 1 per cent. for a sinking fund to pay the bonds at their maturity). Thus, if the full amount of $50,000,000 is expended upon the road, the annual interest charges will be only $1,750,000. The Manhattan Elevated Ry. earned $11,226,000 gross in 1893, and its net earnings in that year were over $5,000,000.

To sum up this part of the argument then, the density of traffic along New York city's axial lines is such as to warrant the construction of the best and most expensive type of railway for its accommodation; and the profitableness of this traffic, as shown by the statistics of traffic and earnings of existing railways, furnishes an ample assurance that such a road, when built, will earn the interest on its costs, and a goodly sum in addition.

But it may be said that it is yet to be shown that the rapid transit railway will be able to draw traffic from the existing lines. We hear the argument repeatedly urged that "people do not want to go under ground until they go to stay." It is said that the tunnel air will be damp, chilly and unwholesome, and that passengers will prefer to ride in the cheerful light of day on the elevated—with, it may be parenthetically added, its endless vistas of flapping clothes lines, shabby house roofs, and unsavory alleys. Let us inquire how much ground there is for this supposition.

As far as the public health is concerned, it is very easy to say that riding on the underground road will injuriously affect health; but we have as yet seen not one statement drawn from actual experience in support of such an assertion. The London underground roads have been in operation many years, and yet, despite their foul air, due to the use of steam locomotives, we have yet to hear that the health of their operatives is seriously affected. But even if it were shown that on the various underground lines operated by steam locomotives, persons with weak lungs had suffered injury from the locomotive gases, that would prove nothing respecting the effect on health of the projected rapid transit line. As a matter of fact, it can readily be shown by indisputable figures, that with such ventilation as it will be possible to secure at a very moderate expense, the air of the subway will be practically the same as that of the street above it. Without taking space for detailed figures, we may merely mention, as an illustration of the small power required for perfect ventilation, that the double-track tunnel, 3,600 ft. in length, of the Pennsylvania R. R. in Baltimore is now ventilated by a fan driven by an electric motor of 45 HP., which can entirely change the air in the tunnel every five minutes.

The question of injury to health, then, may be safely laid one side, and we may turn to the question as to whether mere prejudice is likely to divert present traffic from the underground road. Human prejudice is a difficult thing to account for. When the New York elevated roads were first constructed there were many people who refused to

risk their lives and limbs for "a ride in the air." Even to-day a few timid souls still ride up and down town on the surface cars purely from fear of accident on the elevated roads, and this notwithstanding their wonderful record for safe operation through so many years. So it is doubtless true that a certain small percentage of the people, the class who scent danger at every turn, will steer clear of the underground road as they do of the elevated.

But this class of persons, we all know, is a very small percentage indeed of the "traveling public." It is the universal experience that the question of safety or danger is one to which nine out of ten persons pay little heed in daily life. A comfortable seat in a chair-car will draw traffic to a railway, notwithstanding the fact that it may have weak bridges and few or no fixed signals for train protection. People will not hesitate to ride on the New York rapid transit railway, then, on the score of danger. Are they likely to do so merely because it is an underground line?

We can best answer this question by referring to the record of experience. Passengers swarm to the London underground roads, notwithstanding their vile atmosphere due to the smoke of locomotives. The trains which enter New York city from the north, all passing through the disagreeable Fourth Ave. tunnel, carry nevertheless a constant heavy traffic. The same may be said of the tunnel terminals of Baltimore, St.Louis and other cities. In brief, while some prejudice may exist against riding through a tunnel, there is no evidence to show that such prejudice is ever strong enough to be a material factor in influencing the course of traffic.

But we have thus far proceeded on the assumption that the elevated and the underground roads were equal in other respects. This, however, will by no means be the case. The underground road is located nearer the center of traffic than the elevated, so that it can be reached by a shorter walk. Its cars can be reached by a descent of only 10 ft. or so from the sidewalks, while an ascent of at least twice that amount is necessary to reach the elevated platforms. The cars and stations of the underground line can be brilliantly lighted by electricity, and the passenger once seated with his evening paper will be as oblivious of the fact that he is traveling through a tunnel as the passenger on an ordinary car at night is of the darkness outside. Finally, and most important of all, the rapid transit road can carry its passengers to their destinations in far less time than the elevated lines and this consideration alone, it cannot be doubted, will suffice to attract travel to it regardless of the influence of any prejudices or fears concerning underground roads.

In showing in the preceding paragraph that the rapid transit road, if properly constructed and operated, can draw traffic from existing lines sufficient to make it a paying enterprise, we have presented in some part the considerations which make an underground road better than an elevated. It is true, however, that what we have just said refers to the elevated roads as at present existing, and that an elevated road could be built which would stand more nearly on an equality with the underground line.

It is doubtless true that an elevated road could be built on which trains could be operated at as high speeds and with as much safety as on the proposed underground road. But where could such a road be located? The influence of elevated roads on the value of real estate along their lines is something which New Yorkers are familiar with by experience. Certainly it would not be possible to secure the consent of either the people or the property-owners for an elevated road on Broadway, and the same may be said of practically all the north and south avenues in the central part of the city not already occupied by the Manhattan structures. A "through the blocks" elevated line has been pretty well shown to be not only financially impracticable, but by no means desirable. Practically, then, were rapid transit to be sought by elevated roads, the choice would lie between rebuilding the Manhattan's antiquated structure and building a new road still further removed from the Broadway line, which is generally regarded as the central axis of traffic.

Now it is perhaps true that a four-track elevated line on these locations could be built for perhaps $25,000,000 less than an equal mileage of underground line on the central routes adopted by the Rapid Transit Commission. Supposing it to be true, it is nevertheless maintained that the central route is enough better than the roundabout one to be worth its extra cost. There is one commodity in a great and busy city like New York that is more valuable than even its real estate, and that is the time of its hundreds of thousands of workers. If we set the added cost of the underground over the elevated line at $25,000,000, the interest on this sum at 4% amounts to about $3,000 a day. If we allow only five minutes time as the average saving made by a passenger in a journey in favor of the Broadway line, as compared with any side route on which an elevated road could be built, we have a total daily saving of time by all passengers worth far more than the $3,000 daily interest charge.

Nor is this the whole story in favor of the underground road. While the road now planned by the Rapid Transit Commission can be built at practically no expense for right of way or property damages, no four-track elevated road could be built, either by the city or a private company, without making compensation for property damages along its line which would go far to wipe out the difference in cost of construction between the two systems.

Let us make a comparison from another point of view. Probably no one will question that if the city were to offer to permit a private corporation to build a rapid transit elevated railway over the routes laid down for the underground road, plenty of parties would be eager to secure the franchise to construct and operate the road, and to pay the city a percentage of its operating expenses in addition. But if private capital were to undertake such a work, it would have to float its bonds probably at 5 to 6 per cent.; and thus while the total of its structure would be less than that of the underground road, the annual fixed charges on the two systems would probably be about the same. In other words, the city, by the loan of its credit, will be enabled to secure an underground road at practicaly the same annual interest charge as that on an elevated road.

Among other arguments against the construction of the underground line, it is urged that many years will be consumed in its construction, and that the streets will be obstructed by the work. Regarding the last of these, it should be said that property-owners can far better endure the obstruction of their frontage for a few weeks by gangs of excavators than they can the constant encroachment upon light and air by the structure, and the constant and overpowering noise of the trains of an elevated railway. In fact, the new pipe gallery, which is to put an end to street excavations, and to the frequent obstruction of the street for repaving, will alone compensate for the obstruction of the streets during construction of the underground road. As for the time necessary for building the underground road, if the work is attacked at many points simultaneously, as it may well be, there is no reason why its construction should not be accomplished in a great deal less time than the preliminary work has thus far occupied.

Much more might be said, did space permit, to prove that the work thus far done in preparation for building the New York Rapid Transit Railway has been progress in the right direction; but we trust it may not be necessary. With all the prominence and influence of the parties who continue to oppose the underground enterprise and favor elevated lines, signs are not wanting that the trend of intelligent public opinion is still well indicated by the heavy vote last fall in favor of the loan of the city's credit to the work. The members of the Rapid Transit Commission, moreover, appear to justly appreciate their responsibilities, and show no signs of wavering in their determination to carry out the work of building the underground road on correct engineering and economic principles. Now that the route and the general plan of construction are practically fixed, it is to be hoped that no obstacles may interfere with the rapid progress of the enterprise.

## LETTERS TO THE EDITOR.

### THE IMPORTANCE OF TESTING ANEROID BAROMETERS BEFORE USING.

Sir: I consider it a duty to make the following facts known. Having had occasion lately to procure an aneroid barometer for exploring purposes in high altitudes in Mexico, I went to a well-known and long-established Broadway dealer and purchased one reading to 15,000 ft. I left it for a few days to be tested, and it was handed to me with the assurance that it had been tested and found perfectly accurate. On comparing it, however, with the Henry J. Green mercurial barometer, at the observatory at Zacatecas, Mexico, at an altitude of about 8,000 ft. it proved to be very nearly an inch in error. The director of the observatory corrected mine by means of the adjusting screw, making it agree with the standard.

On returning to New York, the dealer undertook to have my aneroid retested, and furnished me, this time, with a table of corrections. Having lost all confidence in his tests I took the instrument to a well-known maker of barometers and other scientific instruments, and had him furnish me with a certified table of corrections. This table differed, as a maximum, by about 0.3 in. from the one furnished me by the dealer.

My object in writing these lines is to warn others who may need an aneroid to make sure that the instrument is actually and accurately tested before purchasing. Had the dealer simply sold me the instrument over the counter, to take or to leave, at a certain price, the transaction would have been perfectly fair. The unfairness came in when he undertook to test it for me, without evidently having the proper facilities for doing so, and apparently, the first time, without testing it at all. Yours truly, E. S. G.

New York, March 4, 1895.

### THE OLDEST ENGINEERING SOCIETY IN THE UNITED STATES.

Sir: I desire to call your attention to an error in your issue of Feb. 28 (p. 137), wherein it is stated that the Brooklyn Club, the Wa-ca-ma-ha-ga, "may be called the first engineering association in this country." This honor belongs to the Boston Society of Civil Engineers, unless you can produce a record earlier than 1851, the date claimed for the Brooklyn Club. I have in my care the early records of the Boston Society, in which it appears that an informal meeting of gentlemen engaged in civil engineering was held at the United States Hotel, Boston, on April 26, 1848, and as a result of this and several subsequent meetings, the Boston Society of Civil Engineers was formally organized on July 3, 1848. The society was incorporated under an act of the legislature of Massachusetts, approved by the Governor, April 24, 1851, and its corporate existence has been maintained from that time to the present.

While the Brooklyn Club may have "exercised a material influence in founding the American Society of Civil Engineers in 1852," it will be apparent to any one who compares the first constitution of the American Society with that of the Boston Society, adopted and printed at an earlier date, that the authors of the former drew their ideas freely from the latter. This is not surprising, when it is remembered that many of the charter members of the American Society were among the early members of the Boston Society. I have not a list of the charter members at hand, but I remember the name of James Laurie, the first and only president of the American Society prior to November, 1867, who was also a member of the Boston Society at its organization and on its first Board of Direction; that of George M. Dexter, who was president of the Boston Society at the time the American Society was founded, and that of James B. Francis. Among others of the original members of the Boston Society who were later members of the American Society, though they may not have joined at the time of its organization, I recall the names of E. S. Chesbrough, John B. Jervis, Samuel M. Felton, William L. Dearborn and T. E. Sickles.

Without intending to detract in the least from the honors which belong to the Brooklyn Club with the aboriginal name, I feel that with the evidence so far produced I am justified in claiming that the Boston Society of Civil Engineers is the pioneer engineering organization in this country. Yours truly,

S. E. Tinkham,
Secy. Boston Soc. C. E.

Boston, Mass., March 8, 1895.

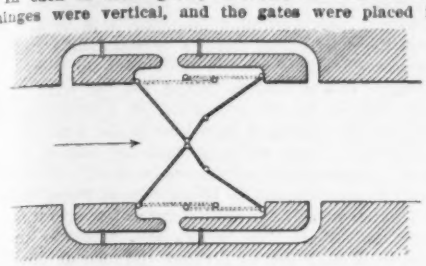
(We have noted editorially another letter on this same subject.—Ed.)

### ADAPTING THE BEAR-TRAP GATE TO CANAL LOCKS.

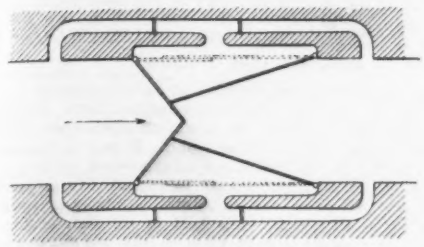
Sir: In connection with the article of Lieut. Chittenden on automatic gates, in your issue of Feb. 7, it may, perhaps, be of interest to those of your readers to whom the information is new, to state that it was proposed in France, ten years ago, to adapt to

use in canal locks gates of the general principles involved in both the bear-trap and the Parker gates. One of these gates was known as the "Porte a vantaux valets," and the other was called the "Porte Fourneyron," from the name of its inventor.

In each of these gates, however, the axes of the hinges were vertical, and the gates were placed in



Porte Fourneyron.



Porte a vanteaux valets.

A French Adaptation of the Bear-Trap Gate for Canal Locks.

pairs, as ordinary lock gates. I enclose herewith a sketch of each of these designs, which require no explanation. It will be noticed that in the Fourneyron gate the folding leaf is on the downstream side, instead of on the upstream side, as with the ordinary Parker gate. Respectfully yours,

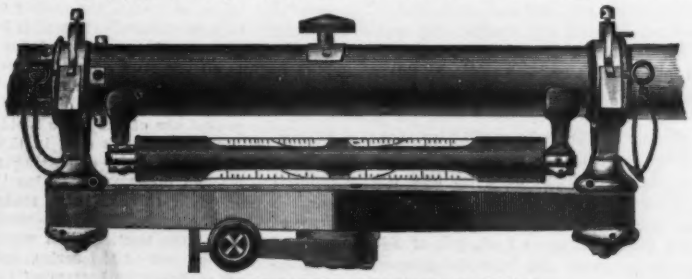
M. Fargusson.

Southport, N. C., Feb. 13, 1895.

## THE REVERSION LEVEL.

Sir: In your issues of Jan. 24 and Feb. 21, 1895, articles have appeared in your correspondence columns on the familiar subject of reversion levels, and as they contain some statements which seemingly call for an answer, kindly permit us to quote a few facts. An instrument provided with a reversion level was made by us and sent to California in August, 1888. Several others of this kind were made to order in 1889, etc. During the year 1892 alone we sent out five wye-levels equipped with reversion levels. For six months we had on exhibition at the World's Columbian Exposition in Chicago (the home of Messrs. Seelig & Kandler), four instruments provided with reversion levels, viz.: two transits, one engineer's wye-level and one engineer's precise level. Since then numerous reversion levels have been applied to transits and levels and other styles of instruments of our manufacture not necessary to enumerate here. Our catalogue of 1895, published in September, 1894, contains an illustration and description of this device as applied to our engineer's wye and precise levels, and as its principal features are somewhat treated differently than in the articles mentioned above, we quote from it as follows:

The spirit level used in this feature differs from the ordinary one in that it is ground to the true shape of a barrel so that the tangents to the level bubble curves, at the zero points of the scales, are parallel and diametrically opposite. By the use of this reversion level, attachable to any of our engineer's wye levels, in place of the single reading level, it is possible to do good leveling, though the adjustments of the spirit level and cross wires are entirely deranged and the collars worn, by first making the level bubble central and taking a reading, then by revolving the telescope 180° in its wyes, which point is indicated by an adjustable stop, by making the bubble again central and taking another reading. The arithmetical mean is the correct result.



BUFF & BERGER'S REVERSION LEVEL.

This device will, in an emergency, be appreciated when it is known that by the use of the method above the work will average as good as that done with the ordinary good wye level, in adjustment. The adjustment of an instrument provided with a reversion level is made in precisely the same manner as if the spirit level were of the single reading kind, since the adjustment of the level when it is reversed will take care of itself.

The reversion level is guarded by a revolvable outer tube (patent applied for) leaving a space of air, as a non-conductor of heat between it and the ordinary level mounting tube. This exterior tube serves both as a protection against breakage and sudden changes of temperature, and, as its inner surface is painted white, it also acts as a reflector, which facilitates the reading of the bubble.

We do not wish to be unkind to Messrs. Seelig & Kandler, but we cannot refrain from remarking that from our point of view, this enterprising firm, now hardly two years in existence, instead of being first to apply reversion levels to wye levels, have been rather slow in adopting an instrumental detail which we have ground and furnished to our patrons for the last six or seven years, and the principle of which has been known to instrument makers for about a quarter of a century. Very respectfully yours.

Buff & Berger.

9 Province Court, Boston, Mass., March 7, 1895.

## THE FERRIS WHEEL ANALYSIS IN "MODERN FRAMED STRUCTURES."

Sir: In "Modern Framed Structures," 3d ed., recently published, the analysis of the Ferris Wheel, p. 72, is not correct. The author has failed to remember that the segments of the rim are straight lines in all cases. In Case I., the stress in any segment of the rim, such as 8, should be

$$S_8 \; r \cos \frac{\alpha}{2} = S_1 \; r \cos \frac{\alpha}{2} + Wr \sin \alpha + Wr \sin 2\alpha + \ldots\ldots + Wr \sin 7$$

hence,

$$S_8 = W \sec \frac{\alpha}{2} \left( -\cot \frac{\alpha}{2} + \sin \alpha + \sin 2\alpha \ldots + \ldots\ldots + \sin 7\alpha \right)$$

The stress in 18, should be

$$S_{18} = W \sec \frac{\alpha}{2} \left( \frac{1}{2} \cot \frac{\alpha}{2} + \sin \alpha + \sin 2\alpha + \ldots\ldots + \sin 17 \right) = 17.211 \text{ W.}$$

In case II., the stress in 1 is correctly given, as $\frac{W}{2} \operatorname{cosec} \frac{\alpha}{2} = 5.737$ W. The stress in 18, should be

$$S_{18} = W \sec \frac{\alpha}{2} \left( -\frac{1}{2} \cot \frac{\alpha}{2} + \sin \alpha + \sin 2\alpha + \ldots\ldots + \sin 17\alpha \right) = 5.737 \text{ W.}$$

The results, as corrected above, agree perfectly with those given in my analysis, published in Engineering News March 22, 1894.

J. W. Schaub.

Pittsburg, Pa., Jan. 25, 1895.

(We referred the above communication to Prof. Johnson, and append his reply as follows:—Ed.)

Sir: Referring to Mr. Schaub's corrections to the analysis of the Ferris Wheel given on p. 72 of "Modern Framed Structures" (3d Ed.), a copy of which has been submitted to me, I may say that I agree with him entirely. Mr. Schaub's equations are strictly correct, and yet so are all the equations given on this subject in the book, except that we have chosen to consider $\cos 5° = 1$, $\sec 5° = 1$, and hence $\cot 5° = \frac{\cos 5°}{\sin 5°} = \frac{1}{\sin 5°} = \operatorname{cosec} 5°$. That is to say, where there are 36 segments in the wheel, the angle subtended by one of these, at the center, is 10°, and this is the angle $\alpha$ in the discussion; whence $\frac{\alpha}{2} = 5°$. The above assumption gives an error of 4 in 1,000, or 2-5 of 1%. This was not considered important.

In the case of the wheel with stiff spokes, a numerical error is made in the book in the third line from the bottom in evaluating the last equation. Since the value of the parentheses was shown above to be "$\frac{1}{2} \operatorname{cosec} \frac{\alpha}{2}$" entered with a plus sign, and since it here enters with a minus sign, we evidently must deduct twice this quantity, whereas the 5.74 there deducted is this quantity itself. The correction here is to substitute 11.48 for 5.74, leaving a remainder of 5.68 instead of 11.42.

I believe Mr. Schaub was the first to publish the correct analysis of this structure, but the method of sections used in the "Framed Structures" gives a neat and general method of solution not previously made public.

J. B. Johnson.

Washington University, St. Louis, March 14, 1895.

## SPECIFICATIONS FOR BUFFALO GRADE-CROSSING WORK; N. Y. C. & H. R. R. R.

A schedule of the work shortly to be undertaken at Buffalo, N. Y., in changing the grades of streets and railway tracks so as to abolish the numerous grade crossings, was given in our issue of Jan. 31, and we present herewith an abstract of the specifications for the excavation, foundations and masonry for the substructure work of the open cut at Main St. and the Terrace, the bridge at Washington St. and the viaduct at Michigan St. This work is to be for the New York Central R. R., and we are indebted to Mr. Walter Katte, M. Am. Soc. C. E., Chief Engineer of the road, for the specifications referred to.

All the excavation is classed as follows: Solid rock, loose rock and earth. Solid rock includes all stones 1 cu. yd. or more (except old masonry) and also all rock in place, which, in the engineer's opinion, cannot be removed without blasting. Loose rock includes all detached stones or bowlders containing more than ½-cu. yd. and less than 1 cu. yd., and all old masonry laid in cement; also all rock in place which, in the engineer's opinion, can be removed without blasting, although blasting may be done to suit the contractor's convenience. Earth is a general and comprehensive term including all excavation of other material than above specified, and including also paving, curbing, sidewalk stone and crosswalk stone. All blasting is to be done with small charges and only black powder is to be used, the blasts being properly covered and fired at such times as directed by the engineer. The price for excavation includes backfilling or depositing within a limit of 1,000 ft. In filling behind retaining walls, abutments and other masonry no garbage or organic matter is to be used, and the filling is to be rammed in layers not more than 12 ins. thick, to guarantee against further settlement.

Piles must be of spruce or Michigan hard pine, not less than 7 ins. diameter at the small end, and 12 ins. at the large end when cut off square. They must be of sound timber, straight; free from rot, shake, large knots and other imperfections; barked, accurately pointed, and properly banded at the head to prevent splitting or brooming while being driven. The points are to be shod with wrought or cast iron shoes when required by the engineer. Timber for foundations, unless otherwise specified, will be of Pennsylvania white hemlock or Michigan hard pine, sound, true to dimensions, and free from sap and other defects. Where such foundations are supported upon bearing piles, the timber must rest closely upon and be secured to each pile by a rag bolt ¾-in. square and 20-ins. long. Where no piles are used the timbers will be evenly spaced and in number sufficient to cover at least two-thirds the area of the foundation. In all cases the spaces between the timbers will be filled in with concrete, gravel or puddle, as may be directed, all well rammed. The covering plank will be well spiked or drift-bolted to each timber.

First-class masonry will include all dimension stone, such as cap stones, bridge seats, steps, dressed parapet wall, coping and wheel guard course of retaining walls. It will be built of sound Yammerthal limestone, or stone of equally good and approved quality, laid in American Portland cement mortar, and each stone will have its top surface, beds and joints finely bush-hammered and cut true and square, or to curvature shown on plans. The stones will be laid so as to form a ¼-in. joint throughout, (except ⅛-in. end joints for coping), and to break joint at least 1 ft. in adjacent courses. The face of all stone will be bush-hammered or rock-faced as directed by the engineer, and rock-faced work will have a 1-in. chisel draft cut on all four edges of the face. First-class masonry will be estimated by measuring each block or stone before it is laid in the work, and the price will include the cost of laying.

Pier masonry will be similar stone, laid in natural rock cement, and will consist of rock-faced ashlar work laid in regular horizontal courses, having parallel beds and vertical joints, the courses to be not less than 10 ins., or more than 30 ins., thick, decreasing in thickness regularly from the bottom to the top of the pier. Stretchers to be not less than 2½ ft., or more than 6 ft., long, with width not less than 1½ ft., nor more than 1¼ times their depth. Headers must not be less than 3½ ft., nor "

more than 4½ ft., when the thickness of the pier will admit, and not less than 2 ft. wide or less in width than in depth. The face will be rock-faced, with edges pitched to straight lines and no face projections exceeding 2 ins. The beds for 12 ins. back from the face and the end joints for 8 ins. back will be dressed to a ⅜-in. joint, and a 1½-in. chisel draft will be cut on each side of any angle or batter line in the masonry. The face stones will be laid on their natural beds as headers and stretchers, at least one-third of the work consisting of headers, so placed as to give the best possible bond, and the stones of one course must break joints with those of the course beneath by at least 9 ins. The backing or filling will be of good-sized, well-shaped stones laid so as to break joint and thoroughly bond the work in all directions, leaving no spaces more than 6 ins. wide, which spaces will be filled with small stones and spawls well grouted.

Second-class masonry will generally be used for retaining walls, abutments, parapets and wing walls, and will consist of random or broken range ashlar, with the face built of the quality of stone already specified, set in natural rock cement mortar and laid with horizontal beds and vertical joints. The face will be as specified for pier masonry, but with ½-in. joints and 1-in. chisel drafts. One-third of the work will consist of headers, which are to be not less than 4 ft. long (when the thickness of wall will admit), with width not less than 2 ft., or less than the height. Stretchers must not expose less than 2 sq. ft. on face of wall, with width not less than 15 ins. nor less than 1½ times their height. Stones not less than ¼-sq. ft. and not less than 4 ins. thick, may be used for leveling up range courses, being set level and laid with a ½-in. joint. The backing will be of large, sound, strong and roughly squared stone from approved quarries, no stone measuring less than 2 cu. ft., and laid with the broadest bed underneath and having a good bearing on the stone below. The stone must be laid in full mortar beds, well bonded with one another and with the face stone, and all spaces must be filled with spawls and small stones well bedded in mortar. No stone will be cut on the wall, and no stone once bedded must be removed unless so directed by the engineer. The bottom courses will be of large flat stones, not less than 12 ins. thick and 10 ft. area of bed, and must extend across the wall where the thickness of wall does not exceed 4 ft. The face of foundation for second-class masonry will be faced for 12 ins. below the top of the foundation courses with the same kind of stone and quality of work as the facing of the rest of the work.

Third-class masonry will generally be used as foundation for pier and second-class masonry, and for the backing of first-class masonry, etc. It will consist of good, strong, sound stones from approved quarries, laid on their natural beds and roughly squared where used for face work. The walls will be carried up in courses 15 ins. to 18 ins. thick, with one header to every three stretchers, not more than one-third of the stone being less than 9 ins. thick nor containing less than 2 cu. ft. and no stone being less than 6 ins. thick. The whole must be laid in natural rock cement mortar, no grout being used, but all spaces being filled with small stones and spawls laid in mortar, or laid dry, if directed by the engineer. The foundation course will consist of large flat stones not less than 10 ins. thick, extending through the wall where the width is 4 ft. or less.

Underpinning masonry for cellar walls will comply, in description, quality and dimensions, with the specifications and rules of the building department and ordinances of the city.

Retaining walls and abutments are to be thoroughly drained with broken stone drains, and openings 4 ins. wide and 6 ins. high, this work being included in the price for masonry. Not more than two unfinished courses will be allowed at one time in any wall, and, as a rule, one course must be completely finished before another is begun. The contractor will furnish all material and labor (unless otherwise specified) and also all temporary planking, shoring, centering and scaffolding. All concrete and masonry, except first-class masonry, will be paid for by the cubic yard, estimated from plans of completed structures, the price including all materials, labor, scaffolding, etc.

The cement used will be the highest grade and best quality of American Portland cement and natural rock cement. Samples of all lots of cement must be subjected to tests of 7, 14 and 28 days, before the cement is used, the inspector selecting samples at random from each cargo or invoice lot as ordered, the number of different samples being not less than 10, or more than 20% of the number of barrels or bags of such lot, and the quality of cement taken being enough to make at least 25 briquettes. Barrels of Portland cement must contain not less than 386 lbs. and barrels of natural rock cement not less than 300 lbs. of cement. The Portland cement must be not less than 97% and natural rock cement not less than 95% "fine" on a No. 50 sieve of 2,500 meshes per sq. in. of No. 35 wire of Stubbs wire gage. The tests are as follows:

1. Neat cement mixed to the consistency of a stiff plastic paste, and made into flat cakes 2 or 3 ins. diameter by ½ in. thick, shall not set so as to sustain without imprint a wire of 1-12 in. diameter, weighing 4 ounces, in less than 20 minutes.

2. Similar cakes to those prepared for the light-wire test, but with thin edges, when hard enough, shall be immersed in water for at least two days. If they crack along the edges, or become contorted, the cement shall be rejected; and Portland cement so tested shall withstand without cracking a temperature of boiling water (212° F.) after 24 hours' immersion in cold water.

3. From the sample mixture shall be made not less than 25 tesfing briquettes. In preparing briquettes for test, sufficient cement shall be taken to make one at a time, using only sufficient water to work into a stiff plastic paste. The water shall be fresh and clean, of a temperature between 60° and 70° F. The proportion of water to be used varies with the fineness, age, and other conditions of the cement, and the temperature of the air, but approximately it will be, for neat cement, from 20 to 30%. The paste thus made shall be firmly pressed into the molds, but shall not be rammed in, and shall be struck off level, the molds resting on glass, slate or other non-absorbent slabs. As soon as hard enough the briquettes shall be taken from the molds, and be kept covered with damp cloths until immersed.

4. Tests for tensile strength shall be made on briquettes of standard form, and no record shall be taken of briquettes that break at any other place than that of their smallest section, which shall be exactly 1 sq. in. For one-day tests the briquettes shall remain on the slab for one hour after being removed from the molds, and then be immersed for 23 hours in water. For all other tests the briquettes shall have a set of 24 hours in air and the balance of the time in water. The temperature of the water shall be kept at 60 to 70° F., and that of the testing room shall not be allowed to fall below 45° F. The breaking tests shall be made immediately after taking the briquettes from the water and the stress shall be applied at a uniform rate, starting from zero, of about 400 lbs. per minute.

5. The average tensile strength per square inch shall be not less than the following:

| | | | | | Am. Port. cement. | Nat. rock cement. |
|---|---|---|---|---|---|---|
| 5 | briquettes | for | 1-day | tests..... | 100 lbs. | 60 lbs. |
| 5 | " | " | 7-day | " ..... | 300 " | 75 " |
| 5 | " | " | 14-day | " ..... | 375 " | 90 " |
| 5 | " | " | 21-day | " ..... | 440 " | 140 " |
| 5 | " | " | 28-day | " ..... | 500 " | 190 " |
| 25 | " | " | Total average..... | | 340 " | 111 " |

Sand for mortar must be clean and sharp bank sand, free from loam and vegetable matter, and if such sand cannot be found in natural beds it must be obtained by washing and screening. The general proportion of sand and cement for common mortar will be 2 sand to 1 cement, and for pointing mortar 1 sand to 1 Portland cement. All cement mortar must be used within half an hour after mixing, and each course of masonry will be grouted with thin mortar of the same quality as above. All outside joints of first and second-class masonry will be raked out to a depth of 1 in. and neatly pointed with Portland cement mortar.

Concrete will consist of 1.6 barrels (480 lbs.) of natural rock cement to 1 cu. yd. of 2-in. stone and clean, sharp sand. In bulk the proportion will be about 25% cement, 25% sand and 50% broken stone, or 9 cu. ft. cement, 9 cu. ft. sand and 18 cu. ft. broken stone. The concrete will be mixed immediately before using, deposited in layers not exceeding 1 ft. in thickness, and thoroughly rammed until the cement flushes to the surface.

Where bricks are used (for sewers, etc.), they must be sound and hard burned, laid in natural rock cement mortar and thoroughly saturated with water before being laid, unless the temperature is below 32° F. Brickwork will be paid for in the work by the thousand, estimating 21 bricks per cu. ft.

The specifications mention two methods of laying masonry in freezing weather, when the temperature is not lower than 22° F. First: A mortar is made of 1 part hydraulic lime and 3 parts sand, mixed thoroughly and allowed to stand in a heap covered with stable manure until used, to prevent freezing; this mortar is mixed for use with ordinary cement in the proportion of 1 to 3, both mortars being saturated with lime in the final mixing. Second: Salt water is used for mixing the mortar; when the temperature is at 32° F. dissolve 1 lb. of rock salt in 18 gallons of water, and add 1 ounce of salt for each degree of temperature lower than 32° F., "or enough salt, whatever the temperature may be, to prevent the mortar from freezing." No masonry laid in freezing weather will be pointed until the spring.

## A WATER-COOLING APPARATUS.*

By Carl Henrich.

In the planning and erection of smelting works, especially of such as contain the modern large water-jacketed blast-furnaces, we are often confronted with an insufficiency in the water supply. It may be impossible to find in the immediate neighborhood of the selected site a sufficient supply to furnish the jackets with cold water, or the water may be highly charged with scale-forming minerals held in solution, or the main water-supply may be pumped from the workings of the mine, and carry iron or copper salts, or even some free acid in solution, all of these substances being derivable from the oxidation of sulphuret ores in the mine. Moreover, such mine-waters sometimes contaminate the waters of the creeks, so that these become unavailable, and we have to fall back on an inadequate supply of pure water furnished by some spring or springs, entirely too small in volume for our needs, unless used over and over again. This last alternative, using the same water repeatedly for the cooling of the water-jackets of a furnace, necessitates, of course, the cooling of the heated water before each new introduction of it into the water-jackets, and the effective cooling of the large volumes of water needed, even within the space of a few hours, for the water-jackets of the modern large blast furnaces, presents the greatest difficulty attendant upon the repeated use of the same water for this purpose.

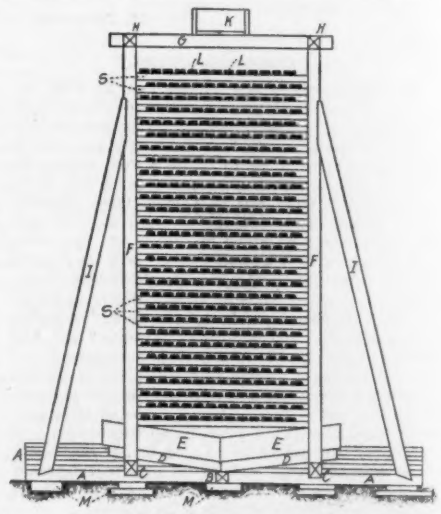



Fig. 1. Cross-Section of Water-Cooling Apparatus.

The writer has seen in the West attempts to solve this problem by employing a series of large shallow wooden tanks. Connection between these tanks was, or ought to have been, made in such a manner that the bottom of one tank would communicate with the top of the next, the hot water entering at the surface at one end of the series, and the cooled water being taken from the bottom of the tank at the other end. But to cool any large quantity of water in this way requires, even in the arid regions of the West, where evaporation is much more effective than is usually the case elsewhere, so large a number of large tanks, costly to build, and costly to keep in effective repair, that this plan cannot be called a success.

Recently in planning and building the smelting plant

*Abstract of a paper presented to the American Institute of Mining Engineers in March, 1895.

of the Pittsburg & Tennessee Copper Co., at Ducktown, Tenn., the writer was confronted with a problem of the kind mentioned above. The country around Ducktown is well watered, and would have seemed, at first sight, the most unlikely region to present such a question. But the drainage of the old mine openings (mostly caved in) empties into the creeks of the region; and these mine waters are so much impregnated with the sulphates of iron (and probably also a little free sulphuric acid) as to make them very undesirable for use in boilers and iron water-jackets. On the other hand, the springs (which are frequent, but not, as a rule, very large) furnish a water almost as soft as rain water, and forming no scale worth speaking of; in other words, an ideal material for such purposes.

A group of springs, immediately below the site selected for the works, yields ordinarily from 35 to 40 gallons of water per minute. In the abnormally long-continued drought prevailing in the region in 1893 and 1894, this supply fell to about 25 gallons per minute, which was taken as the amount to be safely depended on at all times. Arrangements were therefore to be made to make this supply of 25 to 30 gallons per minute sufficient for the needs of the works.

Of the furnace, for the water jackets of which this supply had to be sufficient, the horizontal area at the tuyere level was 120 × 42 ins.; the area at the top of the jackets (which was also the bottom of the charge doors), 126 × 54 ins.; the total height of the jackets, 12 ft. 5 ins. Sixteen 4-in. tuyeres supplied the blast. Besides the jackets of this furnace, a small matte-concentrating cupola, 32 to 36 ins. diameter at the tuyeres, was to be supplied with water from the same source. The water for the boiler could be neglected, as this would be taken from the hot water coming from the furnace; and it would be a factor only in the determination of the size of the pump required for pumping the hot water, as it came from the jackets, to the cooling apparatus.

An Epping plunger pump, with outside packed plunger, 12-in. steam cylinder, 7-in. plunger, and 14-in. stroke, was the compromise between the real requirements of the case and the least possible expenditure desired, but it would have been much better to increase the size of that pump to at least 14-in. steam cylinder, 8-in. plunger, and 14-in. stroke. The pump is rated at 200 gallons per minute, with 100 ft. piston speed; but this speed was often exceeded, when running the furnace to anything like its full capacity—about 240 tons of roasted pyrrhotite ore in 24 hours.

The main problem remains, namely, the cooling of 200 to 300 gallons per minute of water heated to about 180° to 200° F., down to a temperature as near that of the spring water (about 40° F.) as possible. For this purpose the writer designed the simple apparatus here described. While convinced that it would serve its purpose, still he hardly supposed that the small size of the apparatus first built would be sufficient, and fully expected to have to add 50 to 100% in length, or to double the original apparatus, in order to obtain the water sufficiently cooled. But the efficiency of the apparatus in actual practice has proved so great that he feels justified in publishing it for the benefit of others in the profession similarly situated. The apparatus is shown in vertical cross-section in Fig. 1, and the arrangement of the distributing strips, which are the essential portion, is shown in Fig. 2 on an enlarged scale. The apparatus is made of wood throughout. Any kind of wood may be employed which will last in water, and can stand repeated dryings out (in times when the works are idle) and soakings in hot water (when the works are running).

The construction is based on the well-known fact that for a given volume of hot water, other conditions being equal, the velocity of cooling will increase with the increase of the surface, brought into contact with the air. Of course, this cooling is effected mainly through the evaporation of a portion of the water, the heat rendered latent by such evaporation being taken from the remaining portion of the water, while the stream of air moving constantly over the surface of the water serves, in the main, only as the vehicle for carrying off the evaporated water.

This idea was put into practice long ago at some of the salt works of Europe, where the writer has seen it in use for concentrating the weak brine pumped from the salt mines. In these salt works the brine was pumped to the top of long, high, but narrow piles of bundles of willow twigs, tied together, and confined within a light wooden framework, the whole being exposed to the currents of the air, which passed freely through this pile of twigs, while the finely-divided brine dropped from one twig to the other, to be collected in a concentrated state on the floor on which the whole structure rested, and thence flowed to the pans, in which it was boiled down.

In the Ducktown apparatus, modified from this pattern, the framework was retained, but the bundles of twigs were replaced with long, narrow, thin wooden strips (set perfectly level), on which the hot water would spread out, and over the edge of which it would drop upon other strips, put vertically below the interstices left between the layer of parallel strips above. A V-shaped floor was put below this arrangement of strips to collect the cooled water and deliver it, by means of a launder, to the two large tanks, which were to form the reservoir supplying cold water for the smelter.

As constructed, the framework of the apparatus consists of the cross-sills, A A, Fig. 1, set parallel and level, 8 ft. apart c. to c. Each cross-sill was put 2 ins. higher than the one in front of it, so that the seventh cross-sill, at the end of the framework, is 1 ft. higher than the first cross-sill in front. These cross-sills are laid on mud-sills, M, which are made of planks 2 × 12 ins., firmly bedded in the ground. The cross-sills A are joined in the center by a long sill, B, halved into the cross-sills, so that their tops are flush, and two outer sills, C, equidistant from the center sill, B. These sills, C, are 7 ft. apart at their inside edges, and are made of 6 × 6-in. lumber, 8 ft. apart from outside to outside. The center sill, B, is also 6 × 6 ins., while the cross-sills, A, are 4 × 6 ins., put on edge. The outer sills, C, are let into the cross-sills only 2

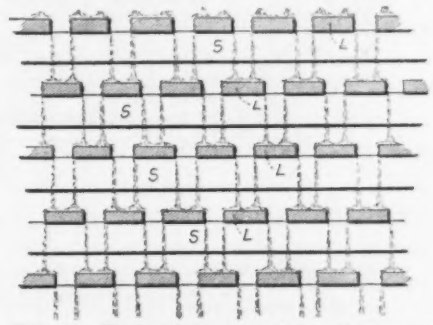



Fig. 2. Enlarged Cross-Section of Part of Water-Cooling Apparatus.

ins., so that the top of these outer sills is 4 ins. higher than the top of the center sill, B.

On the intersections of the outer sills, C, with the cross-sills, A, posts, F, from 16 ft. 6 ins. to 17 ft. 6 ins. in height, made of 4 × 6-in. lumber, are erected, and are braced to the cross-sills, A, by the braces, I, made of 4 × 4-in. lumber. Each pair of posts is joined on top by the cross cap, G, made of 6 × 6-in. lumber; and the seven pairs of posts are joined on top by the two long caps, H, made of the same size. Instead of putting the cross-sills, A, and posts, F, 8 ft. apart c. to c., it would have been better to diminish that distance, as by using 4 ft. distance, i. e., 13 cross-sills, A. 13 pairs of posts, F, and 13 cross caps, G, it would have been possible to put the distributing strips, L, more nearly level, than with supports 8 ft. apart. Besides the braces, I, diagonal braces of 3 × 6-in. lumber are used on the long sides of the framework between the posts, to stiffen the structure. Between each pair of posts, F, strips of wood, S, 2 × 4 ins., and 7 ft. long, are nailed, 6 ins. apart c. to c., perfectly level, and so placed that the distributing strips, L, when laid on these supports, lie perfectly level in the direction of the length of the structure.

The distributing strips, L, are battens 1 × 4 ins., and 16 ft. long, reaching over the length of two panels of the structure, and breaking joints, which adds materially to the stiffness of the whole. The correct placing of these distributing strips insures the efficiency of the apparatus. Each should be perfectly level in both directions (the length and breadth of the structure). Their correct position to each other is shown in Fig. 2, an enlarged vertical cross-section through a part of the center of a panel of the structure. In this figure the distributing strips are shown 4 ins. wide, 1 in. thick, and lying parallel, with interstices 2 ins. wide, in layers 6 ins. apart vertically, c. to c. The water falls over the edge of each strip upon the upper face of a strip immediately below. It spreads out on this level surface or is thrown up, in drops or spray, to be collected on neighboring strips, over the edges of which it falls again, and so on. The nearer to a perfect level the upper faces of these strips are brought, the more perfect will be the spreading out and distribution of the water over the whole apparatus.

Of course this uniform distribution of the water also depends on the arrangement of the holes or slits in the upper trough or launder K, of the apparatus, which is also perfectly level, and into which the water flows from the 4-in. discharge pipe of the hot water pump. The uniform distribution of the water from this launder over the whole length and breadth of the apparatus can be easily accomplished, even after the apparatus is at work, by boring auger holes through the bottom and sides of the launder, which is made of 1½-in. planks.

In practice it has been found advisable to put up a wind break at one side of the apparatus, since, without this protection, any strong wind is liable to carry a large portion of the water in the form of a spray (a perfect rain shower) to one side, beyond the floor of the apparatus. This wind break was made of rough 1-in. planks nailed horizontally to the braces, I, outside from the floor about two-thirds up their length, the upper edge of this lower part of the wind break being then connected by vertical 1-in. planks with the long cap, H, at the top of the apparatus.

The lumber bill for the apparatus described, putting cross-sills, A, and posts, F, 4 ft. apart (in place of 8 ft., as constructed), would be as follows:

| | No. | Section. | Length. | Ft. B.M. |
|---|---|---|---|---|
| M..Mud-sills, about... | 26 | 2 × 12 ins. | 10 ft. = | 520 |
| A...Cross-sills ..... | 13 | 4 " 6 " | 16 " = | 416 |
| B and C..Long sills... | 9 | 6 " 6 " | 18 " = | 486 |
| F...Posts ..... | 26 | 4 " 6 " | 18 " = | 936 |
| I....Braces ..... | 26 | 4 " 4 " | 16 " = | 554 |
| G...Cross-caps ..... | 7 | 6 " 6 " | 18 " = | 378 |
| H..Long caps..... | 6 | 6 " 6 " | 18 " = | 324 |
| Diag. bracing at sides.. | 72 | 3 " 6 " | 12 " = | 1,296 |
| (Not down in Fig. 1).. | 16 | 2 " 6 " | 12 " = | 192 |
| D....Joists ..... | 13 | 2 " 4 " | 10 " = | 86 |
| K..Laun. (24×10½ ins.) | 12 | 1½ " 12 " | 18 " = | 324 |
| E...Flooring (⅞×4 ins.). | .. | ..... | | about 600 |
| S...Supports ..... | 195 | 2 " 4 " | 14 " = | 1,820 |
| L...Distributing strips. | 1,170 | 1 " 4 " | 16 " = | 6,240 |
| Wind break ..... | 36 | 1 " 12 " | 16 " = | 576 |
| | 24 | 1 " 12 " | 14 " = | 336 |
| Total ..... | | | | 15,085 |

Counting the cost of lumber (inclusive of nails and cost of erection) at $20 per 1,000 ft., B. M., and allowing $5 for painting the floor with roofing paint, and $15 for grading and preparing the site, we have as the total cost of the apparatus $321.70, which is certainly as cheap as any apparatus capable of efficiently cooling about 200 gallons of nearly boiling water per minute has ever been built, according to the writer's experience and judgment. The simplicity and cheapness of this efficient apparatus, which may be built by a common carpenter anywhere, seem to justify its description.

## CASTING RAIL JOINTS SOLID FOR CONTINUOUS RAILS.

On several street railways the system of making the rails continuous has been adopted, and electric welding has usually been applied to unite the ends of the rails to form a continuous and unbroken line of steel. A new method now being introduced for forming continuous rails consists in casting molten metal around the rail ends, filling the space and melting the ends of the rails so as to practically weld them together. The molds are of cast iron, lined with a graphite mixture which is renewed once in every 20 joints, and before being clamped to the rail they are made red hot, so as to heat the metal of the rails. The bottom joint of the clamp rests in a pan of sand, and clay or sand is tamped in at the ends and top, while an iron plate across the top of the rails prevents the metal from flowing over the head. About twelve molds are kept in use together. A special quality of cast iron is used. When the rails are hot the metal is poured into the mold and left for ten minutes, when the mold is removed. The rail ends are cleaned before the metal is cast, and if the ends are not close together a thin piece of steel is wedged between them. The cost is said to be about $3 per joint, and the weight is from 50 to 100 lbs.

The plant used consists of a small foundry cupola mounted on swivel bearings on a truck hauled by two horses, an engine, boiler, water tank and blower being also mounted on the truck. Oil fuel is used. The metal is tapped and poured from ladles in the usual way. The plant required and the operations are much cheaper than where electric welding is employed, and a railway company can afford to have its own plant for repairs, etc., while the expense of the welding plant and the necessary use of skilled labor in welding prevent this with the electric system. The metal embraces the web and flange of the girder rail, but not the head, and the weld is more perfect in the base and web, so that in case of a bad joint the casting can be knocked off without affecting the rail head. Alternate joints are cast in the morning, and in the afternoon the remaining joints are cast, the object being to reduce the strain due to the expansion and contraction of the heated rails. The plan has already been tried on a line in St. Louis, Mo. It is being introduced by the Falk Mfg. Co., of Milwaukee, Wis., which company is said to be prepared to take contracts for doing the work.

## THE NEW BUILDING OF THE INSTITUTION OF CIVIL ENGINEERS.

The association now known as the Institution of Civil Engineers, in London, was practically founded in 1817; held its first formal meeting in 1818; elected Thomas Telford its President in 1820, and on June 3, 1828, it was incorporated by royal charter as "The Institution of Civil Engineers." In 1836 the first volume of its Transactions was published, in quarto form, and in 1844 the octavo form appeared, and has been continued since.

In 1838 the Institution entered upon the premises at 25 Great George St., now being remodeled, and the old building was enlarged in 1846 at a cost of about $21,750. The first Secretary of the Institution was Mr. Charles Manby, appointed in 1839, and he continued in active service until 1856, when Mr. James Forrest was made Assistant Secretary, Mr. Forrest having previously been more or less intimately connected with the Institution since 1842. Mr. Forrest was made Secretary on Jan. 3, 1860, and Mr. Manby held the office of Honorary Secretary until his death, July 31, 1884. In 1868 the old building was again enlarged at a cost of about $90,000, including the purchase of additional real estate.

The building now being erected will still retain parts of the old structure. According to an elevation and plan published in "The Engineer," the new building will be two stories in height, with a handsome pillared front of stone, surmounted by an attic story ornamented with the busts of famous engineers. The old meeting-room was 60 × 40 ft. and 30 ft. high, and would seat 450 persons. This is apparently to be retained, with some few alterations, but the library of the Institution now numbers about 50,000 volumes and more space is required to properly accommodate it. The new library will be 80 ft. long by 30 ft. wide, with an additional room 40½ × 24 ft. This second floor also contains a lecturers' room, back of the meeting hall, and a librarian's room. On the ground floor will be the Secretary's room, the Council and a morning room, and the various offices of the staff. The whole building is to be made as nearly as possible fireproof by the use of iron and cement in the floors and partitions.

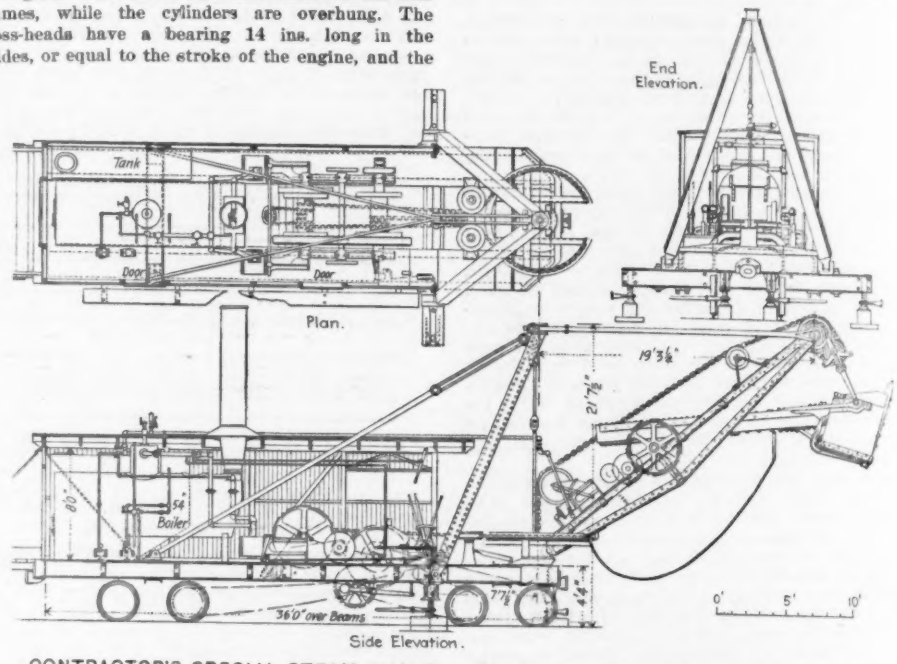
## SPECIAL CONTRACTOR'S SHOVEL; BUCYRUS STEAM SHOVEL & DREDGE CO.

We illustrate herewith the new special contractor's shovel, built by the Bucyrus Steam Shovel & Dredge Co., of South Milwaukee, Wis., for especially hard material. The distinguishing features of this shovel are (1) the high A frame which is built up of steel channels and plates, and (2) the powerful independent thrusting engines on the boom. These engines are capable of creating a thrust of 60,000 lbs., outward on the dipper when it is digging. The dipper is given considerable angle of pitch with the dipper handle so as to make this thrust motion effective when entering the bank. This thrust motion is usually obtained by means of a friction clutch which is driven from the hoisting chain and the use of which consequently absorbs that much effective power from the main engines. By use of these independent thrusting engines the digging power of the bucket is greatly augmented, and special facility is obtained for dislodging large bowlders, etc. In order to safely withstand the application of such a large amount of power, the boom, dipper-handle and dipper are of unusual size and strength, being as heavy as are used in large lake dredges.

In place of the usual wrought iron side arms and braces for attaching the dipper to the dipper-handle, with their multiplicity of parts and connections, a solid cast steel frame is employed. This frame is flanged to fit the dipper shell and the handle and has formed in it eyes to receive the dipper-bail and hinges. Moreover, it is so designed that the line of strain from the dipper-handle and bail intersects in a point, and this point is close to and in line with the teeth. This concentrates all the strains on the upper part of the dipper and brings them in more direct lines. The lower part of the dipper then becomes a receptacle for the material. The lip-plate is of steel and is placed inside the shell, extending over a large part of its interior surface, while the teeth are placed outside, where they are better fitted to take the wear, and they do not require sharpening so frequently as ordinary teeth.

The jack-beam is also a special feature of this shovel. Instead of hinged arms, as in the railroad machines, it has a through jack-beam composed of two 15-in. steel I-beams 18 ft. long. This jack-beam makes a solid base for the A frame, which is stepped upon it by heavy steel castings. All the principal castings throughout the entire machine are of steel, as shown by the fact that there is only 28,600 lbs. of cast iron in this shovel, the total weight of which is 125,000 lbs.

The engines have two cylinders 10 × 14 ins. The guides are bored and cast solid on the side frames, while the cylinders are overhung. The cross-heads have a bearing 14 ins. long in the guides, or equal to the stroke of the engine, and the same principle of large bearing surfaces is carried out in every part of the machine. The frictions are of the outside band type, those of the hoisting and swinging engines being interchangeable.




CONTRACTOR'S SPECIAL STEAM SHOVEL. The Bucyrus Steam Shovel & Dredge Co.

This friction is considered the most satisfactory for continued hard work, as it is easy to handle, and adjust, and always runs cool. The boiler is of the locomotive type and of unusually large size, so that ample steam capacity is obtained without forcing.

This machine is designated as a "special contractor's shovel," because the height and width which it occupies when at work are beyond the railway limit, and for transportation over a railway, it is necessary to dismount the high A frame and jack-beam. In the regular pattern, the height of the A frame is 14 ft. 6 ins., and the jack-beams fold up when not in use, so that the shovel is at all times ready to go over the road when it is lowered.

These shovels have been used quite extensively on the Chicago Drainage Canal for handling the indurated clay and cemented gravel found on certain sections. This material is very hard and bowlders frequently occur weighing from 5 tons to 15 tons. The first shovel was put at work on the section for which McArthur Bros., of Chicago, have the contract, and these contractors now have two at work. The capacity of these shovels is given as follows by the makers:

On McArthur Bros.' sections the general daily average for these shovels for the season was 594 cu. yds. per day of 10 hours, engineer's pit measurement, inclusive of all delays from whatever source. This may seem like a small output for a very large machine, and for short periods was greatly exceeded, but when the circumstances are taken into account and when it is also borne in mind that it is the average for the season, including all delays for repairs, waiting for cars, frost or storms, and also that the measurement is in place and not figured by keeping account of imperfectly filled cars after it is loosened, we think that it is a very creditable showing, and it is such results as these that are of value to the contractor, rather than statements or claims of what machines will do for short periods under favorable conditions.

## CONTRACTS FOR SURVEYS OF GOVERNMENT LANDS.

A correspondent recently asked for information concerning the method under which contracts are let for making surveys of Government lands. In response to this query we have received from the Commissioner of the General Land Office at Washington particulars as to the method of letting contracts, which we publish herewith as follows:

The acts of Congress making the annual appropriations for public surveys require that all rates of mileage in excess of $13, $11 and $7 for the survey of standard and meander, township and section lines, respectively, shall be allowed only on the approval of the Secretary of the Interior, and existing departmental regulations require that bids shall be invited from competing surveyors for the execution of all surveys involving the maximum ($18, $15, $12) and the special maximum ($25, $23, $20) rates of mileage for the respective lines named. For instance, in compliance with official and departmental regulations, the U. S. Surveyor-General for Washington was authorized, per telegram of Jan. 29, 1895, to invite proposals to execute surveys of 1,256 miles of section lines and 131 miles of meander lines within the Colville Indian Reservation, situated in the northeastern part of the state, at rates of mileage not to exceed $25 for meander lines and $20 for section lines, as allowed for public surveys in the state of Washington by act of Congress approved Jan. 25, 1895.

The invitations for proposals are not published in newspapers as advertisements, but consist usually of printed notices posted in the office of the Surveyor-General, the local land office, and the post office, and are also mailed to surveyors residing in the state and the vicinity of the lands to be surveyed. Contracts for public surveys are awarded by the surveyors-general for the several surveying districts.

The list of U. S. Surveyors-General is at present made up as follows:

| | |
|---|---|
| U. S. Marshal, ex-officio Surveyor-General | Sitka, Alaska |
| Levi H. Manning | Tucson, Ariz. |
| W. S. Green | San Francisco, Cal. |
| Thomas D. Robinson | Denver, Colo. |
| W. H. Milton, Jr. | Tallahassee, Fla. |
| Joseph C. Straughan | Boise City, Idaho |
| Chas. H. Dickinson | New Orleans, La. |
| James Compton | St. Paul, Minn. |
| John S. M. Neill | Helena, Mont. |
| Clayton Belknap | Reno, Nev. |
| Chas. F. Easley | Santa Fe, N. Mex. |
| Andrew Blewett | Bismarck, N. Dak. |
| John C. Arnold | Portland, Ore. |
| Richard B. Hughes | Huron, S. Dak. |
| Geo. W. Snow | Salt Lake City, Utah |
| Wm. P. Watson | Olympia, Wash. |
| John Charles Thompson | Cheyenne, Wyo. |

The annual report of the U. S. Geological Survey says that of the 30,000 sq. miles surveyed in the last year, 23,000 sq. miles were new work, and the remainder was a revision of old surveys.

## LEGAL DECISIONS OF INTEREST TO ENGINEERS.

### Authority of Municipal Corporations to Cut Trees in the Street.

The statute which gives the park commissioners of the city of Rochester power to cause trees in the streets to be removed whenever required for public convenience, does not authorize them to remove the trees arbitrarily. The question as to whether a municipal board, in exercising the powers conferred on it by law, encroaches on private rights, is a judicial one.—Ellison v. Allen (Supr. Ct. Special Term, Monroe Co.), 30 N. Y. Supp. Rep., 441.

### Assumption of Risk by Employee.

An employee calking pipe in a trench for waterworks, who is of mature years and of ordinary intelligence, and who knows the liability of such trenches to cave in, and who, a few minutes after seeing the trench in which he is working partially cave in a few feet from him, again goes to work, assumes the risk. The fact that the superintendent assures him that there is no danger, and tells him to return to work, does not relieve him of the assumption of the risk, he being of full age and knowing the danger. The fact that a superintendent promises to remove a danger will not relieve an employee from assumption of risk, where he returns to work, not relying on such promise, but on the superintendent's assurance that there is no danger.—Showalter v. Fairbanks, Morse & Co. (Supr. Ct. of Wis.), 60 N. W. Rep., 257.

### Liability of Municipal Corporations for Defective Plan of Construction.

A city is not liable for injuries caused by a defect in the plan adopted by it in laying a sidewalk. The correct doctrine applicable to such case is ably stated in Carr v. Northern Liberties, 35 Pa. St., 324-329 (when the question of the liability of a municipal corporation for an injury resulting from a defective plan adopted by its common council was under consideration) as follows: "Municipal corporations have often been held liable for carelessness in the exercise of their functions; but if we do undertake to correct the evil in such a case as this, on the ground of carelessness, we do not see how to escape from the necessity of submitting the propriety of all acts of grading and draining in our towns to the decision of juries, for even discretionary acts may be charged to have been ignorantly or carelessly resolved upon. Any street may be complained of as being too steep or too level; gutters as being too deep or too shallow, or as being pitched in a wrong direction; and there may be evidence that these things were carelessly resolved upon, and then a tribunal that is foreign to the municipal system will be allowed to intervene and control the town officers. And the end is not yet; for if a regulation be altered to suit the views of one jury, the alteration may give rise to another case, in which the new regulation will be likewise condemned. This theory is so vicious that it cannot possibly be admitted."—Roach v. City of Ogdensburg (Supr. Ct., Gen. Term, 3d Dept.), 30 N. Y. Supp. Rep., 450.

### Liability of City for Change of Street Grade.

Under a provision of the constitution which provides that private property shall not be taken or "damaged" for public use without compensation, the owner of a lot on a street which was dedicated to the city may recover for damages caused by the grading of the street to the established grade. Evidence of the diminution in the value of the lot by the adoption of the ordinance establishing such grade is inadmissible, as there can be a recovery only for the actual physical change of grade. Benefits to the lot from the operation of a street railway on the street after it was graded cannot be considered to diminish the damages.—Eachus v. Los Angeles Consol. Elec. Ry. Co. (Supr. Ct. of 37 Pac. Rep., 750.

### Compensation of Abutting Owners for Additional Servitude on Public Street.

Where a private corporation, under special legislative enactment and municipal ordinance, constructed a practically solid structure as a bridge approach, 30 ft. wide in the middle of a street 66 ft. in width, the structure imposed a servitude on the rights of abutting owners, for which compensation must be made. The granting of the right to the exclusive and permanent use of a portion of the public street, even where such permission includes as a consequence the construction of a solid roadway over and above the road surface, is not an exercise of the power to alter or change the grade. Equity will restrain the taking of private property for public use, where provision has been made by statute for determining the compensation to be paid the owner, and such payment has been made a condition precedent, until the condition is complied with.—Willamette Iron Works v. Oregon Ry. & Nav. Co. (Supr. Ct. of Ore.), 37 Pac. Rep., 1016.

### Validity of Municipal Bonds.

In the determination of the validity of municipal bonds, two questions of controlling importance are quite often presented. The first one is whether the municipality was empowered by the legislature to issue bonds of the character of those in suit? And, secondly, if such authority is found, but some irregularity or fraud has attended their issue, what effect should be given to representations of facts contained in the bonds, where they have come into the hands of bona-fida purchasers, who have bought them for value, in reliance upon the truth of such representations? As to the question of power, there has been apparently a growing tendency in the courts to look with close scrutiny into the source of the authority for the making and issuing of such bonds, and to deny the power unless it is given expressly or by clear implication. But if the power is found to exist, and bonds have been issued in professed execution of the power containing recitals of things done by the municipality or its officials, in conformity with the requirements of the authorizing statute, and those things are peculiarly within the knowledge and duty of the officials executing the bonds, there has been no relaxation of the rule which protects bona-fida purchasers relying upon the truth of representations made in the bonds against the irregularities and frauds of the municipality or the officials who represent it in the exercise of the power.—Risley v. Village of Howell (Circ. Ct. of Appeals, 6th Circ.), 64 Fed Rep., 455.

### Liability for Defective Street.

Where the defect or obstruction in a street of a city is patent or obvious, and has continued so long that notice may be reasonably inferred, or where the defect or obstruction is one which with reasonable or proper care should have been ascertained and remedied, the city is liable for the injuries resulting from such defect or obstruction.—Union St. Railway Co. v. Stone (Supr. Ct. of Kan.), 37 Pac. Rep., 1012.

---

The report of the Manchester Ship Canal Company of March 1, 1895, shows the following financial condition of affairs for the last half-year: The expenditure on capital account in the last half-year, after deducting the proceeds of the sale of plant and land, was $919,835, making the total cost of the ship canal enterprise to March 1, 1895, $74,166,885. During the period reported upon, the sum of $269,965 was received as ship canal revenue, and the expenses amounted to $212,975, leaving a balance of $53,990 as profit. The profit of the Bridgewater canal amounted to $129,360 more, From actual ship canal traffic the sum of $247,890 was received, an increase of $47,275 over the previous half-year. There was a decrease in passenger revenue amounting to $8,900, but the goods traffic showed an increase of $56,175. The directors expressed themselves as satisfied with the latter increase; but it is not stated that the general shareholders of the ship canal company joined in this expression.

---

A levee, 70 miles long, is proposed by Hon. James C. Harris for the protection of the east bank of the Mississippi River from Hickman, Ky., to Ashport, in Tennessee. Mr. Harris claims that 400,000 acres of rich land could thus be reclaimed, worth, when protected, $20 per acre, or $8,000,000, and it would be worth four times as much in a few years. He estimates the total cost of the levee at $600,000, and seeks to have this section made a levee district on the Arkansas and Missouri plan. Under this plan the general government would pay one-third the cost for the benefit of river navigation, and the state of Tennessee, or the territory benefited, would pay the remainder. The present assessed valuation of this land is $1.50 per acre, on an average, the timber upon it being the basis of valuation; and the state revenue from it is $2,000 per annum.

---

The low fares of Indian railways have frequently been commented upon, but the "Indian Engineer" now claims that they are very high when measured on the basis of the ability of the average wage-earner. Thus, on the East Indian Railway, the third-class fare is about 3-5 ct. per mile, and a laborer's time is worth about 9 cts. per day, while in England the fare is 2 cts. per mile and the wages are over 72 cts. per day. So that while in India a day's pay will carry a man about 14 miles, in England it will carry him 36 miles. This difference is increased by the fact that distances are so much greater in India, and it is suggested that it seems desirable to ascertain if a reduction in long-distance fares could not be made without seriously affecting the present net receipts from passenger traffic.

---

The light railways of the Canton of Geneva aggregate 53 miles in length, out of the 72 miles of railway in that canton, this mileage being divided into 9½ miles of tramway and 43 miles of meter-gage roads. The lines are laid chiefly on the highways, which are from 27 to 40 ft. wide, and the rails are located on one side of the road, as they are in the narrow streets of Geneva. The maximum grades are 1 in 16½, and the sharpest curves, used at crossings and sidings only, are 115 ft. radius; the sharpest ordinary curves are 147 ft. radius. The rails weigh 40 lbs. per yd., and are of the American section, placed on wooden ties, though steel ties are used in towns and villages. The engines have six drivers, coupled, and weigh 16.23 tons loaded. The maximum speed is 15½ miles per hour, with an average of 6 to 9 miles. The passenger cars weigh 9 tons and carry 31 passengers; 23 seated. About one train per hour is run on week days, with an increased service on Sundays. The total cost of the lines, including rolling-stock, averages about $28,750 per mile.

---

The forthcoming report of the Pennsylvania Forestry Commission, of which Mr. Wm. F. Shunk, C. E., is a member, will practically give the first reliable information upon the forest lands of that state, and will include valuable data upon the watersheds of the state and the flow from them in high and low stages between 1874 and 1894. It is discovered by the commission that the state of Pennsylvania practically owns no wild lands; but large tracts in the hands of private owners are pointed out as well adapted to reservation purposes. Mr. Shunk makes a special and useful report upon the cause of high water and floods at Williamsport, showing that a number of tributary streams pour their waters almost simultaneously into a 17-mile reach of the West Branch, below the mouth of Pine Creek. Prof. J. D. Rothrock, of the commission, says that the timbered area of the state is 36% of the whole area; but only 25% of the total area actually produces timber of any value. Over large tracts the soil is so burned out by forest fires that the reproduction of timber is impossible. Hemlock timber is being largely felled for the bark, and its destruction has increased rapidly. In 1875 about 190,000,000 ft. B. M. of pine and 20,0000,000 ft. B. M. of hemlock went through the booms at Williamsport. In 1893, at the same place, the pine output had decreased to about 33,000,000 ft. B. M., and the hemlock had increased to 187,000,000 ft. B. M. Prof. Rothrock says the supply of hemlock cannot last over 15 years longer. In 1894, in different counties, 1,500,000 acres of land were advertised to be sold for taxes, outside of tracts in cities and towns. The timber has been removed from this ground, and it is practically valueless. The commission deems it wise to purchase much of this land, before the soil is further impoverished by fire, and devote it to forest restoration. As to forest fires, one county reports a loss from this cause of $2,000,000 in 25 years, and $300,000 loss in one year. In Potter county one firm reports the loss of 150,000,000 ft. of standing timber during the past few years; and in this county in the last season $500,000 was expended in fighting forest fires. An elaborate table is given in the report tending to show that the tendency towards a diminished flow in the streams in summer months is increased in proportion as the forests are removed.

---

The Harriman tower and amphitheatre, projected as an amusement enterprise in Boston, Mass., would include a steel dome-shaped structure, 300 ft. high, surmounted by a tower 200 ft. high; or 500 ft. in all. It would be located at the Marine Park, in South Boston, and include space for all manner of athletic exhibitions, with a seating capacity of 15,000 people; booths, shops, etc. A spiral railway around the outside of the dome would take passengers to a "Midway" near the top of the dome. Here would be dining rooms, museum, etc. Four elevators will then take passengers to the top of the tower.

---

## BOOK REVIEWS.

THE VENTILATION OF MINES. By J. T. Beard, C. E., Secretary of the State Board of Examiners for Mine Inspectors of Iowa. New York: John Wiley & Sons. Cloth; 12mo; pp. 170; illustrated. No index. $2.50.

This book treats the subject from a mathematical rather than a mechanical point of view, giving various calculations and formulas for air pressures, fan and furnace efficiency, etc., but not entering into any description of the various forms of fans and ventilating machinery. The omission of an index is a very serious omission in a technical book, and the arrangement of the list of contents is unsatisfactory for purposes of reference.

STREET RAILWAY INVESTMENTS: A STUDY IN VALUES. By Edward E. Higgins. New York: Street Railway Publishing Co. Cloth; 8vo; pp. 102, with folding table of statistics; $2.

The writer's object has been to determine what measure of success has been achieved during the three years 1890-1893 by horse, cable and electric railways in cities of various sizes; and from the statistics obtained, together with a careful examination of official reports, he has endeavored to predict in a conservative manner the probable limits of gross and net earning power under different conditions of traffic. The surface railways are sub-divided into seven classes, according to the population of the cities and towns in which they are located. The first class includes lines in towns of less than 15,000 population, and the last class lines in cities of 500,000 population or over. Another chapter is devoted to interurban electric railways. It is pointed out that while cable and electric railways have been even more profitable than horse railways, they have been in many cases capitalized to a point where their net earnings are not sufficient to insure permanent dividends.

MODEL ENGINE CONSTRUCTION. With practical instructions to artificers and amateurs. By J. Alexander. Containing numerous illustrations and 21 working drawings from original drawings by the authors and redrawn by C. E. Jones. Whittaker & Co., London, and Macmillan & Co., New York. 8vo; pp. 324; $3.00.

This is an exceedingly useful and interesting work for amateurs wishing to make a working model steam engine; and by the time the contents of the book are absorbed and its instructions carried out to the point of a finished working steam engine in miniature, the young mechanic should have a very satisfactory knowledge of the use of tools, pattern making, the properties of steam and the working of an engine. Mr. Alexander commences with the description and illustration of the necessary tools; tells how to use them and then follows with the details of the boiler, en-

have double-acting, fixed slide-valve cylinders and are similar in construction to those in commercial use. The working drawings are clear, and with the plans for a locomotive are also given track details. Every amateur mechanic wants to make a model engine; and this book is admirably adapted to aid him in doing it successfully.

POPULAR SCIENTIFIC LECTURES. By Ernst Mach, Professor of Physics in the University of Prague. Translated by Thomas G. McCormack. Chicago: Open Court Publishing Co. 8vo; pp. 313; 84 cuts and diagrams; $1.00. Titles of the Lectures: (1) The Forms of Liquids; (2) The Fibers of Corti; (3) On the Causes of Harmony; (4) On the Velocity of Light; (5) Why has Man Two Eyes? (6) On Symmetry; (7) On the Fundamental Concepts of Static Electricity; (8) On the Principle of the Conservation of Energy; (9) On the Economical Nature of Physical Inquiry; (10) On Transformation and Adaptation in Scientific Thought; (11) On the Principle of Comparison in Physics; (12) On the Relative Educational Value of the Classics and the Mathematico-Physical Sciences.

In his translation Mr. McCormack has well preserved the frank, simple and pleasing style of this famous lecturer on scientific topics. Professor Mach deals with the live facts, the salient points of science, and not with its mysticism or dead traditions. He uses the simplest of illustrations and expresses himself clearly, tersely and with a delightful freshness that makes entertaining reading of what in other hands would be dull and prosy. The 8th, 9th, 11th and 12th lectures are not popular lectures, strictly speaking, as they deal more with the methods and nature of scientific inquiry and are more philosophical. The work as a whole is not a text-book, but a book that any one can read with profit and interest; and it can be especially recommended to the student of physics for the historical sequence of the discoveries, and their scientific results are pleasingly set forth by the author.

THE AERONAUTICAL ANNUAL, 1895. No. 1. Devoted to the Encouragement of Experiment with Aerial Machines and the Advancement of the Science of Aerodynamics. Edited by James Means. Boston, Mass.: W. P. Clark & Co., 340 Washington St. 8vo; 172 pp.; $1.00.

This is principally a compilation of matter relating to aeronautics, commencing with Leonardo da Vinci's treatise on the flight of birds, with facsimiles of his text and illustrations. The writings of Sir George Cayley, of 1809, are given fully; then follow Thomas Walker's tratise of 1810; the paper of F. H. Wenham read at the first meeting of the Aeronautical Society of Great Britain, in June, 1866; Benjamin Franklin's correspondence on this subject, and a short history of ballooning, with illustrations. Prof. S. P. Langley's law for planes of fixed size and weight practically introduces the consideration of the "problem of manflight," by the editor, advocating experiments with soaring-machines launched from considerable heights. An interesting bibliography of aeronautics is given. Mr. Means says that since 1790 no less than 149 patents have been taken out in the United States for flying machines, and he warns experimenters that their diversity is so great that any new machine is more likely to be a new design than a new invention.

NOTES ON RANKINE'S CIVIL ENGINEERING. After the notes of Profs. William Allan and G. W. C. Lee. By David C. Humphreys, C. E., M. Am. Soc. C. E., Prof. Applied Mathematics, Washington and Lee University, Member Engineers' Club of St. Louis, Member Association of Engineers of Virginia. Lexington, Va., 1894. Lithographed from manuscript. 4to; 184 pp.; many diagrams. For sale by the author and by Charles Scribner's Sons, New York. $4.

Rankine's works, though written so long ago, remain classic with engineers, more so probably than those of any engineering writer of his time. The reason is, of course, that Rankine was a mathematician rather than an engineer; and while the mathematical discussion of many engineering problems has been greatly simplified since Rankine's time, progress has been generally far greater in other fields than in mathematics. The student or engineer of ordinary mathematical abilities who takes up Rankine's works is often puzzled to follow the author's discussion. Thirty years ago very much less attention was paid to making easy the path of the student than is the case now, and Rankine, like other great masters, erred by assuming too much knowledge and ability on the part of his readers. Thus it is often difficult to understand how he arrives at the formulas and expressions employed. In the work before us Prof. Humphreys has presented a detailed solution of each difficult expression in Rankine's "Civil Engineering." He carries out these solutions in detail and explains why and how the elements are used. These notes embody the results of many years of experience of the teachers named in making plain the difficult formulas and expressions of Rankine to the students. While the book is printed in photo-lithography from manuscript, the text is exceedingly plain to read and the diagrams are most carefully and neatly drawn. It is a work that should find favor among the engineers who still read Rankine's works as well as among the student class for which it is especially prepared.

THE MEMPHIS BRIDGE. A Report to George H. Nettleton, President of the Kansas City & Memphis Railway and Bridge Company, by George S. Morison, Chief Engineer of the Memphis Bridge. New York: John Wiley & Sons. Oblong folio, 22 × 13½ ins.; 74 pp. of text, with 60 plans, diagrams and photogravures; $10.

This is probably the most complete history of an important modern bridge ever published, both in the text and in the illustrations. It commences with a statement of the events leading to the erection of a bridge across the Mississippi at this point, the first, and thus far the only, bridge over the lower river, and then follows with a general and a detailed description of the structure, showing for each pier the difficulties met with and overcome in sinking them by the plenum pneumatic process nearly 100 ft. below extreme low water mark. Detailed plans are given of each pier; the apparatus used in sinking; the mattresses employed for protection, etc., and with the description of each pier is a full statement of quantities and cost. The latter aggregated $968,987 for the entire substructure. The superstructure is handled in a similar manner, and in the most minute detail of design and cost; so that, with the numerous dimensioned drawings accompanying the text in all cases, the history is very complete. The fact that the channel span is 790½ ft. long, and that two other spans are each 621 ft. long, taken in connection with the deep foundations mentioned, sufficiently illustrates the importance of the engineering problems involved, and explains the ultimate cost of the completed structure, $2,908,144. Mr. Morison, in his report, includes all the names of the engineers and company's employees, 37 in number, and also all the contractors concerned, 17 in all. An appendix includes the several Acts of Congress relating to this bridge, preliminary reports of the Engineer, river and steamboat data, and very full tables of time, cost and materials used in the foundations, together with a record of the sinking of the caissons, and full specifications for masonry and superstructure. The tests of steel eyebars and report of testing committee are included. The illustrations are in all cases exceptionally good, and exceedingly complete.

FIFTH ANNUAL REPORT OF THE METEOROLOGICAL BUREAU and Weather Service of the State of New York, 1893. Under the State Department of Agriculture and in co-operation with the U. S. Weather Bureau. Central Office at Cornell University, Ithaca, N. Y. Prof. E. A. Fuertes, Director. Albany: State Printer. 8vo; 455 pp.; many maps.

This report, transmitted to the legislature on Feb. 5, 1894, covers the work done by the bureau during the fiscal year 1892-93. This bureau was established in 1889, in accordance with the recommendations of Gen. Hazen, in 1881, who was convinced that while the Signal Service system was well adapted to the forecasting of storms, it was wholly insufficient for the thorough investigation of the climatic features of the entire country; he therefore asked the co-operation of the states in this connection. Several of the states at once adopted his suggestion, and by 1883 state weather bureaus were in operation in Ohio, New Jersey, Indiana, Illinois, Michigan, Iowa, Missouri, Kansas and Tennessee. The present Director of the New York bureau, having failed to obtain the aid of the state, in 1888, established a provisional service, mainly by private enterprise, and the results of this work convinced the legislature of its value, and the state service was established by law in 1889, as above stated. At the present time 30 or more states are provided with similar organizations. The New York bureau is administered by three commissioners, including the director, all serving without compensation. In 1893, 75 stations, representing 50 counties, were equipped with thermometers and rain-gages; and in addition to these, 6 stations of the National Bureau and 5 military posts report monthly to the central office, making 86 stations in all. Monthly reports on atmospheric pressure are sent in from 5 stations equipped with barometers, supplementing similar reports from 6 stations of the National Bureau. Anemometers were placed at 10 prominent and widely distributed points in the state; but as voluntary observers cannot be expected to give the degree of care necessary with this complicated apparatus, the results obtained do not warrant the outlay necessary to maintain such records. The total expenses incurred in 1892-93 were $5,383. The report gives tables and maps of mean rainfall and mean temperature for each month; describes the principal features of the weather; the mean monthly maximum and minimum barometric pressure; relative humidity; daily and monthly mean temperatures and precipitation, etc., for the state of New York.

METEOROLOGY, Weather and Methods of Forecasting, Description of Meteorological Instruments, and River Flood Predictions in the United States. By Thomas Russell, U. S. Assistant Engineer. New York: Macmillan & Co. 8vo; 277 pp.; many plates and maps; $4.00.

The main object of the author of this work is to explain the use of the weather maps issued by the government in predicting important changes of weather. The method used is based on the observed conditions of the air as to pressure, temperature and humidity of particular types and the weather following 24 hours or more after the occurrence of the type. Mr. Russell deals first with the effect of the moon and of sun-spots on the weather and with weather periodicy, and then takes up the properties and constituents of the air and its marked features. In the chapter on meteorological instruments, he describes and illustrates the form and use of modern instruments of this class. Temperature and pressure, evaporation, clouds, rain and snow, winds, storms, and tornadoes, form separate chapter heads for treatment. The weather-maps are fully described, as is the method of predicting from them. Under the heading of rivers and floods, the author collects statistics of floods due to various causes, and discusses the peculiarities of rivers, the influence of forests, the effects of silt from mines, and the relation of the weather-maps to floods, and their prediction. This portion of the work applies particularly to the Lower Mississippi River and its tributaries. A separate chapter is devoted to river-stage predictions for the Mississippi, Missouri, Ohio, Tennessee and other rivers of the United States; and in this connection are given collected data, maps of watersheds, and many observations upon the stages of these rivers, with rules for applying the data supplied. A lengthy table of comparative river stages follows, giving these data for each month of the year at prominent points of observation. The work closes with 22 sets of four plates each of sample weather-maps, showing low-pressure areas and average rainfall and frequency for various sections of the country upon certain dates.

L'EAU DANS L'INDUSTRIE, PURIFICATION; FILTRATION; STERILISATION. By P. Guichard, Professor of the Industrial Society of Amiens. Paris; J. B. Bailliere & Sons, 19 Rue Hautefeuille; 12mo. pp. 417; 80 figures, 5 francs.

In this work the author treats of water as used in the various industries; the qualities it ought to possess according to the uses to which it is to be put; its impurities and the methods of determining these. The author first takes up the impurities of water, and treats of these, in detail and separately, by chemical, bacterial and volumetric analyses and microscopic examinations of sedimentary deposits. The dissolved gases, mineral constituents and the organic matter contained in water are all treated of at length with illustrations. Under the head of bacterial analysis the various microbes found in water and in other substances are illustrated and described. In the second part of the work, the bodies forming the impurities of water are considered; including gaseous and solid products, and the method of testing for each one is given.

The industrial uses of water form the third part, and under this head M. Guichard includes the general properties and compositions of the various waters used for industrial purposes, such as rainwater, water from glaciers, lakes, swamps, the sea, rivers, artesian wells, mines, wells and cisterns and condensed steam. The manufacture of artificial ice is described, along with many types of refrigerating machines. The degree of cold which various fish, frogs, etc., can stand and yet be restored to life is shown in a series of experiments and the effect of extreme cold upon eggs, infusoria, and especially upon microbes, is considered at length. In the latter case the author concludes that while all chemical phenomena cease at a temperature of —100° C. and at —200° C., life is suppressed in all germs, spores, etc., this life reappears in the presence of heat, and development goes on as if the extreme cold had never been encountered. The use of ice in drinkables, for preserving food and in distilleries, sugar factories and breweries comes under this head. The alteration of water in pipes, conduits and steam boilers is taken up.

The Fourth Part discusses residuary waters from mines, factories, etc., and shows how these impurities can best be treated. The purification of natural water follows. Under the head of filtration come the small machines and filters used for household and minor supplies, apparatus for sterilizing water by heat, and various methods of purifying water for industrial purposes by evaporation, distillation, acids, alkalies and salts. The section on the purification of water for use in cities briefly treats of sand filtration and purification by iron and by permanganate of potash.

The final chapters of this work deal with the polluted waters of cities and industrial establisments, the bacteria found therein, and of the disposal of these waters by sewers, filtration and irrigation and chemical reagents. Under this head the disposal of waste matter by cremation also comes.

This work, as a whole, contains much valuable detail touching the subject under consideration. The mechanical and chemical processes described are generally well known to American engineers; and the chief value of the work lies in a systematic gathering together in one volume of much matter now widely scattered, especially that relating to the use of water for various industrial purposes.

CONTENTS OF SUPPLEMENT.

PERSONALS..... 89
ENGINEERING SOCIETIES..... 89
Coming Technical Meetings..... 89
NEW PUBLICATIONS..... 90
Trade Publications..... 90
CONSTRUCTION NEWS:
List of Contracts Pending..... 90
Railways..... 91
Street and Electric Railways..... 92
Electric Light and Power..... 92
Bridges..... 93
Buildings..... 93
Water-Works..... 93
Irrigation..... 94
Sewerage..... 94
Garbage Disposal..... 94
Streets and Roads..... 94
Miscellaneous Contracts and Supplies..... 94
Contract Prices..... 95
Metal Market Prices..... 95
INDUSTRIAL NOTES..... 96

## PERSONALS.

Mr. C. E. Martin, Superintendent of Bridges & Buildings of the Florida Central & Peninsular R. R., died March 2 at Starke, Fla.

Mr. W. B. Storey, Jr., has been appointed Chief Engineer of the San Francisco & San Joaquin R. R., with offices at San Francisco, Cal.

Mr. Charles E. Wise, the aeronaut, who was engineer of a balloon corps during the Civil War, died at Jenkintown, Pa., March 12, at the age of 59.

Mr. C. C. Pudor, who died at St. Albans, Vt., March 6, was for many years Division Engineer on the Madison Division of the Chicago & Northwestern Ry.

Mr. George M. Van Nort, who was Commissioner of Public Works in New York city from 1871 to 1875, succeeding Mr. Wm. M. Tweed, died at Nyack, N. Y., March 15.

Mr. R. A. Cairns, C. E., City Engineer of Waterbury, Conn., delivered a lecture on "Water Supply" before the students of the Rensselaer Polytechnic Institute at Troy, N. Y., March 15.

Mr. Nikola Tesla, the well-known electrician, had his laboratory at 35 South Fifth Ave., New York city, destroyed by fire last week, and lost thereby many valuable models, papers and experimental apparatus.

Mr. Harry L. Stannard, Assoc. M. Inst. C. E., who invented the steel needle-beams for tunneling near the surface of streets which were described and illustrated in our issue of Dec. 20, 1890, died in South Africa recently, at the age of 35.

Mr. Gerald Holsman, Supervisor of Signals on the New York Division of the Pennsylvania R. R., has been appointed Supervisor of the Road Department, with offices at Jersey City, N. J., and has been succeeded by Mr. George P. Miller.

Mr. Edwin McGinty, County Road Superintendent, was killed at Vicksburg, Miss., March 14 by the fall of a wooden bridge, which was being torn down. He was standing on the bridge when it collapsed and fell into the creek 40 ft. below and was crushed in the wreck.

Mr. Frederick E. Sickels, whose death was noted in our issue of March 14, was for several years Chief Engineer of the National City Water-Works Co., of Kansas City, Mo., in charge of the mechanical department. Among his many inventions was a sand-bar plow, to be towed by river steamers.

Mr. David Barnes, M. Am. Soc. M. E., M. Am. Soc. C. E., Mechanical and Consulting Engineer, has transferred his offices from the Rookery Building, Chicago, to 1750 Monadnock Block, Chicago, where he will continue his business as a general consulting mechanical engineer. Mr. Barnes makes a specialty of locomotive design and construction, and the conducting of tests of stationary and marine engines.

Mr. Jacob A. Harman, M. Am. Soc. C. E., has resigned his position as city engineer of Peoria, Ill., and, together with his present partner, Mr. Wallace C. Evans, will devote his time entirely to general engineering practice and the development of the business of the Crescent Stone Co., of Peoria, Ill., in which he is interested. Mr. Harman was appointed city engineer of Peoria in June, 1893, and since holding that office has prepared plans for 15 miles of pavement and 45 miles of sewers, in addition to designing and carrying out various minor city works, and superintending the construction of 12 miles of sewers, plans for which were prepared previous to his appointment.

Mr. Lemuel E. Stone, Commissioner of Dams and Reservoirs, of Rhode Island, died at Providence, R. I., March 14. He had been chief engineer of construction of many lines of railway in New England, the middle states and different sections in the West. He was connected with the Providence, Warren & Bristol R. R. as its superintendent from May 7, 1856, to June 13, 1871, when he was succeeded by his son, Waterman Stone. He made the preliminary survey and constructed the Providence & Springfield R. R., and, besides being a director in the corporation, was its first Superintendent and Treasurer. He had held the position of Commissioner of Dams and Reservoirs since the office was created in 1882, being reappointed each year.

Mr. Frederick J. Mills, of Pocatello, Idaho, has been appointed as the first State Engineer of Idaho, in accordance with acts creating a State Engineering Department passed by the session of the legislature which has just closed. Mr. Mills entered the engineering department of the University of Vermont in the class of 1886, but left college to engage in professional work before his course was finished. For a number of years he has been engaged in railway, irrigation, and other engineering work in Idaho, and has at different times served on the U. S. Coast and Geodetic Survey's and the U. S. Geological Survey. He has been a member of the Idaho legislature, and was Lieutenant-Governor of the state at the time of his appointment. Most of the work devolving upon the office will relate to irrigation.

Mr. Charles B. Hyde, Civil Engineer, died at his home at Jackson, Mich., March 12. He was born at Franklin, Conn., Oct. 2, 1816. In 1841 he graduated from the Rensselaer Polytechnic Institute, after which he was instructor in mathematics in the academy at Mexico, N. Y. In 1851 he was appointed assistant engineer on the Oswego Canal, where he remained until 1860, for the latter part of this time being First Assistant Engineer under Resident Engineer M. S. Kimball, with headquarters at Syracuse, N. Y. He removed to Michigan in 1866, and was engaged in the survey and construction of the Air Line R. R., from Niles to Ridgway, until 1872, when he entered the employ of the Michigan Central R. R. In 1873 Mr. Hyde was appointed City Engineer of Jackson, Mich., and held this position for six years. In 1883 he was engaged as contractor for grading on the Chicago & Grand Trunk R. R. east of Jackson. Soon after the completion of this work he retired from active practice, and lived quietly at his home.

Mr, Alfred Giles, Past President of the Institution of Civil Engineers, died in London on March 3. Mr. Giles was born in London in 1816, and was the son of Francis Giles, a well-known civil engineer. In 1833 he was employed on the surveys of the London & Brighton and other railways. He later was made an assistant to his father, who was Engineer to the Southampton Dock Co., and in 1847 succeeded his father in that office, and held it until 1892, when the docks were purchased by the London & Southwestern Co. While acting for the Southampton Dock Company he was also at times engaged in other engineering work, including the preparatory works of the London & Southampton Ry. and the Reading & Reigate line. In 1852-53 he designed and built the Upton bridge over the Severn, and for constructing docks in Copenhagen he was made a Knight of Danebrog in 1853. In 1860 he visited Canada to report upon the proposed Great Western Ry. He was prominently connected with the Union Steamship Co., running between Southampton and South Africa, and was chairman of that company from 1882 to 1894. He was President of the Institution of Civil Engineers in 1893-94.

## ENGINEERING SOCIETIES.

### COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
March 23. Secy., C. C. Brown, City Engineer.
WISCONSIN POLYTECHNIC SOCIETY.
March 26. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
DENVER SOCIETY OF CIVIL ENGINEERS.
March 26. Secy., H. Breen, 36 Jacobson Block.
CENTRAL RAILWAY CLUB.
March 27. Discussion on "Car Door Fastenings." Secy., H. D. Vought, Buffalo "Courier," Buffalo, N. Y.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
March. 28. Secy., C. H. McLeod, 12 Mansfield St., Montreal.
FRANKLIN INSTITUTE, PHILADELPHIA.
March 29. "Niagara on Tap," by T. C. Martin. Secy., W. H. Wahl.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
April 1. Secy., C. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
April 1. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
COLUMBIAN ENGINEERING SOCIETY.
April 2. Secy., W. F. Hart, University Building, 15th and H. Sts. N. W., Washington, D. C.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
April 3. "Specifications for Structural Steel," by H. H. Campbell. Secy., C. W. Hunt, 127 E. 23d St., New York.
ENGINEERS' CLUB OF ST. LOUIS.
April 3. "Methods of Determining the Heating Power of Coals," by J. H. Kinealy. Secy., W. H. Bryan, Turner Block.
WESTERN SOCIETY OF ENGINEERS.
April 3. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
April 5. Secy., O. H. Van Geldern, 319 Market St., San Francisco.
ENGINEERS' CLUB OF PHILADELPHIA.
April 6. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF KANSAS CITY.
April 8. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
April 9. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
April 9. Secy., F. A. Coburn, Case Library Building.
NORTHWESTERN RAILWAY CLUB.
April 9. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NEW ENGLAND RAILROAD CLUB.
April 10. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
April 11. Secy., Jas. K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
April 11. Secy., H. D. Ruhm, Nashville, Tenn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
April 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF MINNEAPOLIS.
April 15. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
April 16. Secy., W. D. Crosman, Club Room 9, Grand Pacific Hotel, Chicago.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
April 17. Secy., J. H. Pilcher, Roanoke, Va.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
April 17. Secy., F. Van Vleck, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
April 17. Secy., S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
NEW YORK RAILROAD CLUB.
April 18. Secy., John A. Hill, 256 Broadway, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
April 18. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
April 18. Secy., J. F. Wilson, Odd Fellows' Temple.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
April 18. Atlanta, Ga., Secy., F. A. Charlot, Macon, Ga.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 14. Secy., D. W. Meeker, St. Paul, Minn.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The annual convention will be held at the Hotel Pemberton, Nantasket, Mass., beginning June 18. The hotel has been secured for the exclusive use of the society. All of the proposed amendments to the constitution on the ballot which was canvassed on March 6 were carried.

On the evening of April 3, Mr. H. H. Campbell will present a paper on "Specifications for Structural Steel," and the discussion of this paper will be taken up in connection with that of the report of the committee on "Uniform Methods of Testing Materials Used in Metallic Structures, and on Requirements for these Materials to Further Improve the Grade of Such Structures."

BOSTON SOCIETY OF CIVIL ENGINEERS.—The annual banquet was given at the Exchange Club on March 12, the president, Mr. W. E. McClintock, in the chair. Addresses were made by Mr. George S. Morison, President of the American Society of Civil Engineers; Mr. George G. Crocker, Chairman of the Boston Transit Commission; Mr. Osborne Howes, Commissioner on Greater Boston, and others.

SCHENECTADY TECHNICAL ASSOCIATION.—The annual meeting was held March 18. The following officers were elected for the ensuing year: President, James E. Sague, M. E.; First Vice-President, Olin H. Landreth, C. E.; Second Vice-President, Gustave Faure; Recording Secretary, Hugh L. Boxall; Corresponding Secretary, Arthur M. Lane; Treasurer, Alfred E. Weiner; Librarian, Calvin H. Chambers; Committee on Membership, John E. Yorkston, Jos. E. Fell, and Fred C. Coseo. Prof. Maurice Perkins, Professor of Chemistry in Union University, gave a lecture on "The Origin, Refining, and Uses of Petroleum."

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the annual meeting on March 12 the reports of the secretary, treasurer and librarian were read and accepted, and the president, Mr. Swasey, then read the annual address, taking as his subject "The Specialist in Engineering." The following officers were elected for the coming year: President, Augustus Mordecai; Vice-President, Chas. W. Wason; Secretary, F. A. Coburn; Treasurer, Jas. C. Wallace; Librarian, James Ritchie; First Director, Walter Miller; Second Director, John L. Culley.

WESTERN RAILWAY CLUB.—The regular monthly meeting of the club was held at Armour Institute, Chicago, March 19, and was opened with a discussion of the paper on signaling read by Mr. Geo. Gibbs at the February meeting. This paper was published in our issue of March 14. The discussion on signaling was followed by a continuation of the discussion on stationary boiler practice and shop heating, which was begun at the February meeting. An abstract of the main points brought out in these discussions will be given in a future issue. These discussions were followed by a paper on "The Train Staff System," by Mr. C. A. Goodnow, Division Superintendent, Chicago, Milwaukee & St. Paul Ry. This paper gave a description of this method of moving trains as applied on the Chicago, Milwaukee & St. Paul Ry.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on March 6 the secretary read a letter from the chairman of the American Society of Mechanical Engineers' Committee on Standard Gages for Thickness, requesting the appointment of a committee to co-oper-

ate with them and a committee of the American Railway Master Mechanics' Association. A committee of three was appointed, consisting of Messrs. E. D. Meier, J. H. Kinealy and W. H. Bryan. Prof. J. B. Johnson then addressed the club on the subject of "Wood Structure," explaining in detail the characteristics of the various woods commonly found in the markets, and the methods and appliances used in testing their strength. It was shown that the strength of a wood depends upon the proportion of solid to porous matter, the former being due to the rapid spring growth and the latter to the slower summer and fall growth. He also showed that the strength was reduced as the percentage of moisture increased. He considered this the real explanation of Prof. Lanza's statement that large pieces of timber were weaker than small ones, as the laboratory tests had shown no difference in this respect. William H. Bryan, Secy.

MONTANA SOCIETY OF CIVIL ENGINEERS.—At the meeting on March 9 Mr. Ray, of the committee which has been endeavoring to secure the passage of the county surveyor and road law bills by the legislature, reported that while it had been unable to secure the passage of those bills as originally drafted by the society, it did succeed in the passage of house bill No. 356 and a substitute for house bill No. 124, and that while these bills left much to be desired, they were a step in the direction of securing good roads without additional expense, and that by carrying on a campaign of education, in a few years it would be possible to obtain the proper legislation to put the location and construction of highways in the hands of men trained to the work.

## NEW PUBLICATIONS.

REPORT OF THE RAILROAD COMMISSIONER OF RHODE ISLAND. Report for the Year Ending Dec. 31, 1891, Made to the General Assembly at its January Session, 1895. Edward L. Freeman, Railroad Commissioner. Providence, R. I. Cloth, 8vo; pp. 118; illustrated.

Nearyl all the incorporated railways of this state are leased to other roads, and as the rentals have in general been promptly paid, the usual dividends have been declared and the stockholders have suffered little, if any, loss from the serious business depression of 1894. During the latter part of the year there was a great increase in passenger traffic, while the development of freight traffic severely tested the capacity of some of the roads. The railway companies own and operate 2,515.78 miles, of which 465.8 miles (reckoned as single track) are in this state. All of the 1,932 cars for passenger service have automatic brakes, and of these 1,381 have the improved quick-acting pattern of brake. Of the 888 locomotives, 735 are equipped with driver brakes, but of the 18,190 freight cars only 1,652 are equipped with automatic train brakes and 4,324 with automatic couplers. There are 878 cars heated by direct steam from the locomotive and 1,002 by steam heaters. There are 252 bridges, of which 157 are of wood and 71 of iron. Accidents to trains and at grade crossings, etc., caused 31 deaths and 73 cases of injury. There are 240 grade crossings and 218 farm or private crossings, but the Commissioner states that few roads make the same returns from year to year, so that the number reported continually changes, even though there has been no change in the crossings. Of the road crossings 71 are protected by gates and flagmen, and 92 by flagmen only, but all the grade-crossing accidents last year occurred at crossings guarded by gates and flagmen. At Providence much of the heavy preliminary work has been done for the new terminal system. The street railways aggregate 138.98 miles, of which 122.18 miles are owned or operated by the Union Ry. Co., of Providence. Electric heaters have been applied to many of the cars. The electric cars at Pawtucket are hauled by horses over the dangerous grade crossings at Broad St., but negotiations are pending for an overhead crossing. The Commissioner recommends that a law should be passed compelling the street railway companies to put fenders and wheel guards on their cars. The report contains a description of the O'Neil electric alarm for grade crossings, and also several views of the work in progress for the new Providence terminals, including the Gaspee St. bridge illustrated in our issue of Nov. 15, 1894.

TYPHOID FEVER IN THE DISTRICT OF COLUMBIA: Report submitted by the Medical Society of the District of Columbia to the Committee on the District of Columbia of the House of Representatives, June 14, 1894. Washington: Pub. Doc. 8vo; paper; pp. 18; four diagrams and five large folding maps.

This is a careful study of the subject named, with a graphic presentation of the results of the investigation. Of the large maps, one shows the location of each death in residences from typhoid fever and malarial diseases for the years 1888 to 1892, inclusive, and another shows the same facts for diarrhoeal diseases. A third map shows the location of existing and recently removed pumps drawing water from surface wells. A fourth map shows the location of "box privies" in 1894, and the last map shows old water courses within the district. The committee makes recommendations looking to the improvement of the water supply and sewerage systems, the abandonment of wells within the city limits and the careful inspection of the milk supply, including the dairies from which the milk comes.

ENGINEERING SOCIETY OF THE SCHOOL OF PRACTICAL SCIENCE, TORONTO: Papers Read During the Year 1893-94. Published by the Society for Distribution Among the Members and Engineers. 8vo; paper; pp. 78; illustrated.

The papers included in this volume are as follows: President's address, Jas. D. Shields; "Professional Prospects," by Alan Macdougal; "The Removal and Destruction of Garbage," by J. H. Chewett; "The Beeton Water-Works System," by J. R. Pedder; "The Crawford Gold Mine," by J. McAree; "Notes on Cement," by T. Kennard Thompson, Assoc. M. Am. Soc. C. E.; "Asphalt and Asphalt Paving," by F. N. Speller; "Proposed St. Clair and Erie Canal," by J. C. Macnabb; "Mount Brown and Sources of the Athabasca," by Prof. A. P. Coleman; "A Canoe Trip on the Saskatchewan," by L. B. Stewart.

METROPOLITAN WATER SUPPLY: Report of the Massachusetts State Board of Health. F. P. Stearns, M. Am. Soc. C. E., Chief Engineer. 8vo; cloth; pp. xxxvii., 233; 14 plates. Boston: Address the State Board of Health.

The contents of this volume were abstracted at length in our issue of March 7. The present rate of growth of urban population in this country makes it probable that in the future many groups of municipalities will desire to co-operate in carrying out such public works as sewerage and park systems, as is already being done by the Metropolitan Sewerage and the Metropolitan Park Commissioners for Boston and vicinity, and is proposed for a water supply for these same communities in this volume. As a guide and inspiration for work of this sort the report under consideration is almost invaluable.

STANDARD DICTIONARY OF THE ENGLISH LANGUAGE. New York: Funk & Wagnalls. 4to; pp. 2,238; illustrations, 5,000; $12 to $22.

The second volume of this excellent new dictionary has now been issued, completing the work, which is certainly one of the best and most complete dictionaries in existence. It is said that there are 301,865 vocabulary terms, and that 247 editors and specialists and 500 readers for quotations have been engaged on the work, which has cost nearly $1,000,000. It is printed in a small but clear type, with numerous illustrations, and several handsome colored plates of seals, flags, coats of arms, etc. The work has already been reviewed in our issues of June 1, 1893, and March 22, 1894.

IRRIGATION IN UTAH: Report of the Irrigation Commission to the Third National Irrigation Congress, Held at Denver, September, 1894. Irrigation Work and Conditions in Utah, and Problems of the Arid West. Salt Lake City, Utah: Utah Irrigation Commission. 8vo; paper; pp. 128; numerous illustrations. Copies can doubtless be had free on application to the Commission.

A great variety of information in regard to irrigation in Utah and allied questions is presented in this volume by a number of different writers. Most of the illustrations are half-tone views of Utah scenery, more or less directly connected with irrigation.

### TRADE PUBLICATIONS.

CONSTRUCTING AND QUARRYING MACHINERY.—The American Hoist & Derrick Co., St. Paul, Minn. Paper; 7 × 10 ins.; pp. 168; illustrated.

This is the latest catalogue of these well-known manufacturers of quarrying machinery and derricks of all kinds, and quite fully displays the great variety of hand and power derricks, winches, jacks, hoisting engines and miscellaneous supplies, which they are prepared to furnish. The illustrations are especially notable for the large number of views of actual work on which some of the company's devices have been used. Perhaps the most noticeable of these is the view of the steel guy derrick, with 130-ft. mast and double booms, each 120 ft. long, now being used in removing rock on Section 14 of the Chicago Drainage Canal.

THE VENTURI METER. Builder's Iron Foundry, Providence, R. I. 8vo; paper; pp. 42.

The present edition of this catalogue contains some new matter, including a number of views of meters, registers and the buildings covering the same. The meter register house for the 36-in. meter on the waterworks of Worcester, Mass., is a very pleasing structure, of brick, with a tiled domed roof

PIPE, GAS TANKS AND STRUCTURAL IRON WORK. Davis & Farnum Mfg. Co., Waltham, Mass. Paper; 12mo; pp. 56.

This company manufactures apparatus for coal and oil gas works, water-works, etc., including cast iron pipe and specials, roof trusses, stand-pipes, gasholders, portable lead furnaces, coal barrows, etc. Several pages are devoted to tables of coal analyses, wire gages, weight of pipe, flow of gas, etc.

STEEL WALL TIES. J. B. Prescott & Son, Webster, Mass. 8vo; pp. 32.

This is a descriptive catalogue and price list of the Morse patent steel wall ties for bonding hollow and veneer walls, terra cotta work, face brick, ashlar, etc. The ties are twisted rods of different shapes, built into the mortar or cement between the bricks or stones.

GRANITE BLOCKS AND ASPHALT PAVING.—New York & New Jersey Granite & Paving Co., Postal Telegraph Building, New York city. 16mo.; pp. 16.

This little pamphlet contains particulars of the company's granite for block and asphalt paving, and for building purposes, and its Trinidad asphalt for paving. The granite quarries are near Pompton, N. J.

THE VAN VRANKEN FLUSH TANK. J. Leland Fitz Gerald, Schenectady, N. Y. 8vo; paper; pp. 23.

This illustrated pamphlet describes the well-known flush tank of the above name, and includes 23 tables of use to hydraulic engineers, a number of which are original with Mr. Fitz Gerald.

SPECIAL PUMPS. Deane Steam Pump Co., Holyoke, Mass. Four small pamphlets.

These little pamphlets are devoted to the company's automatic receiver, triplex power pump, patent pumping apparatus for artesian wells, etc.

SEAMLESS DRAWN BRASS PIPE FOR PLUMBING. American Tube Works, 79 State St., Boston, Mass. 16mo; paper; pp. 68.

Most of the space in this pamphlet is taken up with testimonials from users of brass pipe.

## CONSTRUCTION NEWS.

### CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

| Bids to be opened. | Work. | Place. | See Eng. News. |
|---|---|---|---|
| Mar. 22. | Public building at Sioux City, Ia. | | Mar. 7 |
| Mar. 23. | Dredging, Montgomery, Ala. | | Feb. 21 |
| | Advertised Eng. News, Feb. 21 to Mar. 14. | | |
| Mar. 22. | Electrical supplies, Baltimore, Md. | | Mar. 14 |
| Mar. 22. | Telford paving, Newark, N. J. | | Mar. 14 |
| Mar. 22. | Electrical materials, Philadelphia, Pa. | | Mar. 14 |
| | Advertised, Eng. News, Mar. 14 and 21. | | |
| Mar. 22. | St. Ry. roadbed, Cohoes, N. Y. | | Mar. 21 |
| Mar. 22. | Garbage removal, Chicago, Ill. | | Mar. 21 |
| Mar. 22. | Boilers (two 175-HP.), Troy, N. Y. | | Mar. 21 |
| Mar. 23. | Cement, Montgomery, Ala. | | Feb. 21 |
| | Advertised, Eng. News, Feb. 21 to Mar. 14. | | |
| Mar. 23. | Canal (6½ miles) Ottawa, Ont. | | Feb. 21 |
| Mar. 23. | Sewer bonds ($50,000), Cleveland, O. | | Feb. 28 |
| Mar. 23. | Brick paving, Cincinnati, O. | | Feb. 28 |
| Mar. 23. | Office building, Pittsburg, Pa. | | Mar. 7 |
| Mar. 23. | Paving (11,400 sq. yds.), Marion, O. | | Mar. 7 |
| Mar. 23. | Masonry abutments, Denver, Colo. | | Mar. 14 |
| Mar. 23. | Removal of wreck, Philadelphia. | | Mar. 14 |
| Mar. 23. | Brick paving, Indianapolis, Ind. | | Mar. 14 |
| Mar. 25. | Water bonds, Evanston, O. | | Feb. 28 |
| Mar. 25. | Water bonds, Winton Place, O. | | Feb. 28 |
| Mar. 25. | Dam, etc., Cambridge, Mass. | | Feb. 28 |
| | Advertised Eng. News, Feb. 28 and Mar. 7. | | |
| Mar. 25. | Water bonds, Evanton, O. | | Feb. 28 |
| Mar. 25. | Street improvements, Streator, Ill. | | Mar. 7 |
| Mar. 25. | Pipe sewers (88,881 ft.), Pittsfield, N. J. | | Mar. 7 |
| | Advertised, Eng. News, Mar. 7. | | |
| Mar. 25. | Water bonds, Hanover, Kan. | | Mar. 7 |
| Mar. 25. | Water-works system, Hanover, Kan. | | Mar. 7 |
| Mar. 25. | Bridge, Yonkers, N. Y. | | Mar. 7 |
| Mar. 25. | Lighting, Helena, Mont. | | Mar. 14 |
| Mar. 25. | Water supply, Jersey City, N. J. | | Mar. 14 |
| Mar. 25. | Brick paving, Zanesville, O. | | Mar. 14 |
| Mar. 25. | Asphalt paving, Jersey City, N. J. | | Mar. 14 |
| Mar. 25. | Electrical equipm't, Webb City, Mo. | | Mar. 21 |
| Mar. 25. | Granite curbing, Washington, D. C. | | Mar. 21 |
| Mar. 26. | Street imprvt. bonds, Pleasant Ridge, O. | | Feb. 28 |
| Mar. 26. | Dredging plants, Pittsburg, Pa. | | Feb. 28 |
| Mar. 26. | Steel bridge, Denver, Colo. | | Mar. 7 |
| | Advertised, Eng. News, Mar. 7. | | |
| Mar. 26. | Supplies for navy y'd, Mare Isl., Cal. | | Mar. 7 |
| Mar. 26. | Macadamizing, Glencoe, Ill. | | Mar. 14 |
| | Advertised Eng. News, Mar. 14. | | |
| Mar. 26. | Gun metal castings, Baltimore, Md. | | Mar. 21 |
| Mar. 26. | Paving, etc., Evanston, Ill. | | Mar. 21 |
| Mar. 26. | Granite block paving, New York | | Mar. 21 |
| Mar. 26. | Water pipe, etc., St. Louis, Mo. | | Mar. 21 |
| Mar. 26. | Street improvement bonds, Toledo. | | Mar. 21 |
| Mar. 27. | Plans for school bldg., Milwaukee, Wis. | | Feb. 7 |
| Mar. 27. | Smokestack, etc., Toledo, O. | | Feb. 21 |
| Mar. 27. | Bridge, Toledo, O. | | Feb. 28 |
| Mar. 27. | Stone paving, Cleveland, O. | | Feb. 28 |
| Mar. 27. | Dam, etc., Woonsocket, R. I. | | Mar. 7 |
| | Advertised, Eng. News, Mar. 7 to 21. | | |
| Mar. 27. | Approach to pub. bldg., Lowell, Mass. | | Mar. 14 |
| Mar. 27. | Dredging, Brooklyn, N. Y. | | Mar. 21 |
| Mar. 27. | Park improvements, New York, N. Y. | | Mar. 21 |
| Mar. 27. | Sewer bonds, New Bedford, Mass. | | Mar. 21 |
| Mar. 27. | Water-wks. system, Meadville, Pa. | | Mar. 21 |
| Mar. 27. | Fence around Piedmont Pk., Atlanta. | | Mar. 21 |
| Mar. 27. | Brick sewer, Hoboken, N. J. | | Mar. 21 |
| Mar. 28. | Channel work, New Orleans, La. | | Mar. 7 |
| Mar. 28. | Court house bonds, Troy, N. Y. | | Mar. 14 |
| Mar. 28. | Sewer, New York, N. Y. | | Mar. 21 |
| Mar. 28. | Broken stone, New York, N. Y. | | Mar. 21 |
| Mar. 28. | Pipe sewers, Newark, N. J. | | Mar. 21 |
| Mar. 28. | Flagging, Newark, N. J. | | Mar. 21 |
| Mar. 28. | Cement (5,000 bbls.), W. Newton, Mass. | | Mar. 21 |
| | Advertised, Eng. News, Mar. 21. | | |
| Mar. 28. | Dredging (100,000 cu. yds.), Baltimore. | | Mar. 21 |
| Mar. 29. | Bridge bonds, Winnipeg, Man. | | Feb. 21 |
| Mar. 29. | Elevators for pub. bldg., New York. | | Mar. 7 |
| Mar. 29. | Curbing, etc., Richmond, Ind. | | Mar. 14 |
| Mar. 29. | Pipe sewers (3 miles), Roselle, N. J. | | Mar. 14 |
| | Advertised, Eng. News, Mar. 14 and 21. | | |
| Mar. 29. | Electric wiring, etc., Philadelphia, Pa. | | Mar. 14 |
| Mar. 29. | Paving 27 alleys, St. Louis, Mo. | | Mar. 21 |
| Mar. 29. | Fire engines, etc., Baltimore, Md. | | Mar. 21 |
| Mar. 29. | Self-prop. autom. dump. boat, N. Y. | | Mar. 21 |

Mar. 30. Water-works system, Pawling, N. Y....Feb. 28
Advertised, Eng. News, Feb. 28 to Mar. 21.
Mar. 30. Pipe sewers (14,772 ft.), Marion, O....Mar. 7
Mar. 30. Wharfwork at Blackbeard Island, Ga...Mar. 14
Mar. 30. Building shops, Pittsburg, Pa.....Mar. 14
Mar. 30. Sidewalks, Houston, Tex.....Mar. 14
Mar. 30. Sewer, Sandusky, O.....Mar. 14
Mar. 30. Pipe sewer, Davenport, Ia.....Mar. 21
Mar. 30. Manhole frames (360), Medford, Mass..Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Mar. 30. Pipe sewers (20,477 ft.), Medford, Mass.Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 1. Brick paving (20,000 yds.), Newark, O..Feb. 21
Apr. 1. Sewer, Keokuk, Ia.....Feb. 28
Advertised Eng. News, Feb. 28 and Mar. 7.
Apr. 1. Water bonds, Bancroft, Ia.....Feb. 28
Apr. 1. Tunnel sewer, Keokuk, Ia.....Feb. 28
Advertised Eng. News, Feb. 28 and Mar. 7.
Apr. 1. License to cut timber, Toronto, Ont...Mar. 7
Apr. 1. Granite block pav'g, Cincinnati, O....Mar. 7
Apr. 1. Water-wks. supplies, Oil City, Pa.....Mar. 7
Apr. 1. Revetment work, Duluth, Minn.....Mar. 7
Apr. 1. Steel forgings, Washington, D. C.....Mar. 14
Apr. 1. Barracks, Omaha, Neb.....Mar. 14
Apr. 1. Main sewer, Jefferson City, Mo.....Mar. 14
Advertised, Eng. News, Mar. 14.
Apr. 1. Macadamizing, etc., Paterson, N. J.....Mar. 21
Apr. 1. Dredging, Cleveland, O.....Mar. 21
Apr. 1. Electric lighting, Chester, Pa.....Mar. 14
Apr. 1. Iron bridge, Gloversville, N. Y.....Mar. 21
Apr. 1. Laying 20-in. pipe, Medford, Mass.....Mar. 21
Advertised, Eng. News, Mar. 21.
Apr. 1. 30-in. wrought steel pipe, Cleveland, O..Mar. 21
Apr. 2. Dredging, Boston, Mass.....Feb. 28
Advertised Eng. News, Feb. 28 to Mar. 21.
Apr. 2. Brick paving, Waukegan, Ill.....Mar. 14
Advertised, Eng. News., Mar. 14 and 21.
Apr. 2. Stone curbing, Peoria, Ill.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 2. Arteslan well, Canton, Ill.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 2. Life saving station, Washington, D. C..Mar. 21
Apr. 2. Piers, Philadelphia, Pa.....Mar. 21
Apr. 2. Steel wire and manila, Boston navy yd..Mar. 21
Apr. 2. Artificial stone walks, Winton Pl., O...Mar. 21
Apr. 2. Stone paving, Brookiyn, N. Y.....Mar. 21
Apr. 2. Brick paving, Trenton, N. J.....Mar. 21
Apr. 3. Brick paving, Elkhart, Ind.....Mar. 21
Apr. 3. Brick paving, Davenport, Ia.....Mar. 21
Apr. 4. Water bonds, Norwood, O.....Mar. 7
Apr. 4. B'kwater w'k, etc., G'nd Rapids, Mich.Mar. 14
Apr. 4. Constructing bldg, Plattsburg, N. Y...Mar. 14
Apr. 4. Brick paving, Peoria, Ill.....Mar. 14
Advertised, Eng. News, Mar. 14 to 28.
Apr. 5. Pipe sewers, St. Louis, Mo.....Mar. 21
Apr. 5. Brick sewers, St. Louis, Mo.....Mar. 21
Apr. 5. Brick paving, Averyville, Ill.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 5. School buildings (5), St. Louis, Mo....Mar. 21
Apr. 5. Water bonds, Forestville, N. Y.....Mar. 21
Apr. 5. Pumping machinery, Knoxville, Ill.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 5. Street improvements, Wooster, O.....Mar. 21
Apr. 5. Dredging, Wilmington, Del.....Mar. 14
Advertised, Eng. News, Mar. 14 to Apr. 4.
Apr. 5. Electric light plant at Milwaukee, Wis..Feb. 28
Apr. 5. Heat'g & vent'g app't's, St Louis.....Mar. 7
Apr. 6. Paving, Newark, O.....Mar. 21
Apr. 6. River improvements, Savannah, Ga.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 6. Sewers, Plattsburg, N. Y.....Mar. 21
Apr. 6. Jetty, Portland, Ore.....Mar. 21
Apr. 6. Electric light fixtures, Milwaukee, Wis. Mar. 21
Apr. 8. Bridge bonds ($200,000), Portland, Ore. Mar. 14
Apr. 8. Jail, Williamson, W. Va.....Mar. 14
Apr. 8. Dredging, New York, N. Y.....Mar. 21
Advertised, Eng. News, Mar. 21 to Apr. 4.
Apr. 8. Highways (7 miles), Houston, Tex.....Mar. 21
Apr. 8. Water bonds ($15,000), Coleman, Tex...Mar. 21
Apr. 9. Water-wks. system, Seneca, Kan....Mar. 7
Advertised, Eng. News, Mar. 7.
Apr. 9. Sewers, Westfield, N. J.....Mar. 21
Advertised, Eng. News, Mar. 21.
Apr. 10. Buildings at Fort Meyer, Va.....Mar. 14
Apr. 10. Water bonds ($60,000), Westville, N. S..Mar. 21
Apr. 10. Water-works system, Celina, O.....Mar. 21
Advertised, Eng. News, Mar. 21 and 28.
Apr. 10. Sewers, Cincinnati, O.....Mar. 21
Apr. 10. Dam, Nashua, N. H.....Mar. 21
Advertised, Eng. News, Mar. 21.
Apr. 10. Iron gratings, Mansfield, O.....Mar. 21
Apr. 11. Sewers, Peoria, Ill.....Mar. 21
Advertised, Eng. News, Mar. 21 to Apr. 4.
Apr. 11. Composite light vessel, Wash'ton, D. C..Mar. 21
Apr. 12. Breakwater, Davids Island, N. Y. H....Mar. 21
Apr. 12. Brick paving, Springfield, O.....Mar. 21
Apr. 13. Road improvement bonds, Athens, O...Mar. 21
Apr. 15. Sewer bonds South Orange, N. J.....Mar. 14
May 15. Plans, etc., for bridge, Montreal .....Jan. 24
Advertised, Eng. News, Jan. 24 and 31.
Apr. 15. Water-works system, Westville, N. S...Mar. 21
Apr. 15. Dams & shore protec., Rock Isl., Ill....Mar. 21
Advertised, Eng. News, Mar. 21 to Apr. 11.
Apr. 15. Paving dikes, New York, N. Y.....Mar. 21
Apr. 15. Water power plant, West Troy, N. Y...Mar. 21
Apr. 15. Dredging, Portland, Me.....Mar. 21
Advertised, Eng. News, Mar. 21 to Apr. 11.
Apr. 16. Stone dikes, Cincinnati, O.....Mar. 21
Advertised, Eng. News, Mar. 21 to Apr. 11.
Apr. 17. Sewers (27 miles), Champaign, Ill.....Mar. 14
Advertised, Eng News, Mar. 7 to Apr. 5.
Apr. 18. License to cut timber, Toronto, Ont....Mar. 21
May 20. Water bonds, Santa Clara, Cal.....Mar. 7
Advertised, Eng. News, Mar. 7 to 28.
May 23. Water-wks. system, Santa Clara, Cal..Mar. 7
Advertised, Eng. News, Mar. 7 to 28.
No date. Railway (300 miles), Palestine, Tex....Mar. 14
Advertised, Eng. News, Mar. 14.
" .Water-wks. system, Lake View, Mich...Mar. 21
" .Artesian well, Weatherford, Tex.....Mar. 21
" .Electric railway (10 miles), Stowe, Vt...Mar. 21
" .Dynamo, etc., Frostburg, Md.....Mar. 21
" .Electric ry. (28 miles), Baltimore, Md...Mar. 21

## RAILWAYS.

### East of Chicago.

BALTIMORE & OHIO.—It is stated at Uniontown, Pa., that work will be commenced this spring on the extension of the Confluence and Oakland branch of this road from its present terminus at Manor Lands, Md., to Mountain Lake Park, Md., 18 miles. The extension has been projected for several years.

CARTHAGE & ADIRONDACK.—Wm. J. Semper, of Watertown, N. Y., has the contract for the extension of this railway, noted last week. The line will be about 3½ miles in length, with comparatively light grade, and is being built for the benefit of the Newton Falls Paper Co.

CHICAGO, INDIANA & EASTERN.—A press report from Wabash, Ind., states that Frank Root, Pres. Chicago, Indiana & Eastern Ry., now being constructed from Muncie to Peru, has filed a trust deed covering the right of way, tracks, and grade, and personal property of the line, to the Illinois Trust & Savings Bank of Chicago. The lien is for $15,000 a mile, and will cover nearly 100 miles of right of way. The money received on the deed is to be used in construction work.

CLEVELAND, AKRON & COLUMBUS.—This company is negotiating $2,200,000 of 40-year 5% gold bonds. The proceeds will be applied to the retirement of the floating debt, extensions, new equipment, etc. The proposed connection with the Ohio Southern will be made, the extension from Columbus to Lebanon will be built, and terminal facilities in Cleveland secured.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Press reports quote George Kittredge, Ch. Engr., as stating that improvements for the present year will be the changing of the line between Springfield and Columbus, O., doing away with several grades and a number of curves. Regarding new shops at Indianapolis, he says all depends on the earnings of the next 90 days and the prospects for fall traffic.

MILFORD & MANCHESTER.—The projectors of this railway from Milford to Manchester, N. H., are reported to have secured subscriptions for over 1,200 of the necessary 3,000 shares of stock, and at a meeting at Milford, N. H., March 9, it was decided to make application for a charter. The construction of this railway would give Manchester a more direct route to the West over the Fitchburg, but the project is opposed by the Boston & Maine and Concord & Montreal companies.

NEW JERSEY & NEW YORK.—This company is reported as making extensive improvements on its line and about to add another track to Spring Valley.

SEBASTICOOK & MOOSEHEAD.—Z. D. Lancaster, Pres., Fredericton, N. B., is reported as stating that this road will certainly be extended from Hartford toward Monson the coming summer. If the Athens people accept the propositions offered that city they will get rail connection with the outside world in 1895; otherwise the road will swing easterly and go through Harmony or St. Albans.

TOLEDO, WINONA, & WESTERN.—It is reported that Chicago and St. Louis capitalists are interested in a project to build a railway from Sheldon, Ill., to Toledo, O., to be called the Toledo, Winona & Western. The route as now surveyed passes Winona Lake, on which has been located the Presbyterian Chautauqua grounds. A preliminary survey of the route has been made, and Rensalaer, Winamac, Plymouth and Fort Wayne, Ind., are named as points on the line.

WELLSVILLE, COUDERSPORT & PINE CREEK.—It is reported at Wellsville, N. Y., that this railway is to be extended this spring from Perryville to Gold, seven miles, where it will connect with the Goodyear road. This arrangement will give direct connection between Wellsville, Williamsport, Philadelphia, and Washington.

### Southern.

CHARLESTON, CLENDENIN & SUTTON.—John H. Drake, Managing Director, 1326 Chestnut St., Philadelphia, writes us that surveys have been completed, nearly all the right of way secured and the capital for the construction obtained for this railway, which will be about 100 miles in length. About 20 miles have been completed and are in operation, and 30 miles more are under contracts, of which 18 are nearly ready for the track. Pres., C. C. Lewis, Charleston, W. Va.; Ch. Engr., J. Wainwright, Pittsburg, Pa.

DARIEN & WESTERN.—Frank M. Baker, Ch. Engr., Addison, N. Y., writes us that 12 miles of this road was completed March 10, making 33 miles in all. The projected length is 69 miles. The work is being done by the company. Pres., W. F. Cochran, Yonkers, N. Y.

OCALA & ALTOONA.—Press reports from Ocala, Fla., state that F. J. Hinson, of Altoona, Fla., is making surveys for a railway from Ocala to Altoona, passing through Sharp's Ferry, where it would cross the Ocklawaha River, thence through Moss Bluff and Orange Hammock. From Altoona it will run due east, cross the St. Johns River, through De Land, Crow's Bluff, and then to New Smyrna, on the Atlantic coast.

### Northwest.

CARPENTERSVILLE, ELGIN & AURORA.—Incorporated in Illinois to build a railway from a point in the north line of Dundee township, in Kane county, to a point in the south line of Aurora township, in the same county; capital stock, $50,000; incorporators, Alfred B. Church, David B. Sherwood, William Grote, James B. Lane, E. Dunbar Waldron and George M. Peck, all of Elgin, Ill.

GRAND MARAIS & NORTH SHORE.—Incorporated in Minnesota, with a capital stock of $500,000, by Edward E. Lewis, of Grand Marais, and G. S. Anderson, O. E. Erickson, C. E. Bateman and W. E. Bateman, of Minneapolis.

LANGENBURG & SOUTHERN.—Notice is given that application will be made at the next session of the Canadian Parliament for a charter for this company, with power to construct a railway from Langenburg in Assiniboia, to join the Canadian Pacific at some point between Red Jacket, in the same district, and Elkhorn, in Manitoba, and also a branch to Binscarth, in Manitoba. Kingsmill, Saunders & Torrance, Solicitors for the Applicants.

ST. PAUL, MINNESOTA & ASHLAND.—C. H. Pratt, of Minneapolis, chief promoter of this railway from Minneapolis to Lake Superior, was at Washburn, Wis., last week in conference with the business men regarding the location of terminals there. He gave assurance that the road would be built this year, and asked that Bayfield county subscribe $100,000, either by way of bonus or guarantee of bonds. Ashland has agreed to give $110,000. It is estimated that the road can be constructed on a bonded indebtedness of $15,000 per mile.

### Southwest.

CHOCTAW, OKLAHOMA & GULF.—Geo. S. Good & Co., South McAlester, Ind. T., write us that about 50 miles of the grading is completed and all the timber and other work well advanced on this extension. About 700 teams and 1,800 men are at work on the line, and very satisfactory progress is being made. It is expected to have the work done by June 1. The extension is about 120 miles in length.

DALLAS TERMINAL RY. & UNION DEPOT.—We are informed that right of way has been secured by this company for a double-track belt line to connect all the railways reaching this city. About nine miles of double track will be built at first, and a large union station. Pres., W. C. Connor, Dallas, Tex.

JEFFERSON CITY & LEBANON.—It is reported that the citizens of Lebanon, Mo., are trying to secure the construction of a railway from Lebanon north to Bagnell, 35 miles, in order to secure direct connection with Jefferson City. The Missouri Pacific has a line from Jefferson City to Bagnell, 47 miles. The people of Lebanon will give right of way, station grounds and $25,000 in aid of the road, and other points are expected to raise $100,000. James T. Bradshaw, of Lebanon, Mo., is interested.

KANSAS CITY, FORT SCOTT & MEMPHIS.—A press report from Pueblo, Colo., states that Carlile & Dittmar, railway contractors, shipped their outfit from Pueblo last week to commence the construction of an extension of this railway, beginning just across the Arkansas line from Missouri. This firm is said to have a contract to build 80 miles of the road.

KANSAS CITY BELT LINE.—A decree of the court last week granted the Union Terminal R. R. Co. a long-disputed right to cross the tracks of the Missouri Pacific and Union Pacific just west of the Kaw River bridge. This belt line will now be completed as soon as possible. It will be nearly 60 miles in length, of which 48 miles have been built. The system is known in Missouri as the Kansas City Suburban Belt R. R., and in Kansas as the Union Terminal, and is being built by the Missouri, Kansas & Texas Trust Co.

PEOPLE'S R. R. & TELEPHONE CO.—Incorporated in Kansas March 7; capital stock, $56,000,000; directors, John H. McLeod and Findley Murchison, of Marietta, August Hohn, T. D. Hatfield, G. A. Scammon, Dennis Sale and A. M. Judson, of Marysville. The company proposes to build and operate three lines of railway, according to press reports. The north line will run through the counties of Doniphan, Brown, Nemaha, Marshall, Washington, Republic, Jewell, Smith, Phillips, Norton, Decatur, Rawlins and Cheyenne. The central line will run through Johnson, Douglas, Shawnee, Wabaunsee, Geary, Dickinson, Saline, Ellsworth, Barton, Rush, Ness, Lane, Scott and Wichita. The south line will run through Crawford, Neosho, Wilson, Elk, Butler, Sedgwick, Kingman, Pratt, Edwards, Kiowa, Ford, Gray, Haskell, Grant and Stanton.

RIO GRANDE NORTHERN.—C. Kiel & Co., of San Antonio, Tex., have about five miles of this railway graded, and the work is progressing rapidly on the next ten miles. The line extends from Chispa, Tex., on the Southern Pacific, to the San Carlos coal mines, a distance of 26 miles.

SOUTHERN PACIFIC.—A press report from St. Martinville, La., states that J. Kruttschnitt, Gen. Man., Houston, Tex., is making a survey between St. Martinville and St. Johns plantation, about three miles above, to build a continuation of the St. Martinville branch road to that place. The road will run on the east side of the Teche, and will cross the Bayou Teche at St. Martinville on an iron bridge opposite the depot. The Southern Pacific company proposes to build the road further up in the event of the erection of another refinery between Bayou Bridge and St. Martinville.

SPRINGFIELD, SEDALIA, MARSHALL & NORTHERN.—Press reports from Sedalia, Mo., state that O. A. Crandall, Pres., is reviving this projected railway.

### Rocky Mt. and Pacific.

AMADOR, PLYMOUTH & JACKSON.—Incorporated in West Virginia March 12 to construct a railway in California; capital stock, $500,000, commencing with $1,000; incorporators, S. H. and W. W. Emmens, H. C. McCoy, L. G. Haskins and O. C. Martin, all of Amador, Cal.

OREGON CITY & WILHOIT SPRINGS.—Incorporated in Oregon to construct a railway from Oregon City to Marquam, Clackamas county; capital stock, $205,000; incorporators, F. K. Arnold, Charles H. Caufield, H. H. Johnson, Sidney Smith and L. S. Porter; main office at Oregon City.

PRESCOTT & ARIZONA CENTRAL.—Thos. S. Bullock, Pres., is reported as trying to secure the assistance of the Southern Pacific for the construction of a competing railway from Prescott to Phoenix, connecting with the Southern Pacific.

WHITE RIVER VALLEY.—Incorporated in Colorado March 16 to build a railway from New Castle, in Garfield county, to Meeker, the metropolis of the White River country, a distance of 50 miles. This road will open up to settlement 10,000 square miles of territory in Colorado; capital stock, $350,000; incorporators, A. C. Drumm, of Denver; E. Marshall; H. J. Hay, I. N. McBeth, and W. M. Kinnison, of Garden City, Kan.; W. F. Teagarden, of Craig, Colo.; Isaac Baer, of Leadville, Colo., and F. E. Sheridan, of Meeker, Colo.

### Foreign.

EGYPT.—A press report from Cairo, Egypt, states that the council of state has decided to extend the railway to Assouan.

MEXICAN NATIONAL.—A press report from Matamoras, Tex., states that it is announced in that city that the branch of the Mexican National which now runs from that city to the town of San Miguel will be immediately extended to Nueva Laredo. The extension of this road has been under consideration for several years. The action of the U. S. Congress in prohibiting the shipment of goods in bond into the free zone of Mexico will, it is claimed, force business to the Mexican side of the border, and in order to profit by this change the border railway will be built, connecting with water transportation at the mouth of the Rio Grande.

## STREET AND ELECTRIC RAILWAYS.

STOWE, VT.—Bids are asked for the construction of the Mount Mansfield Electric Ry., between this village and Waterbury, a distance of 10 miles. The company has purchased a water power having a 65-ft. head, and the town of Stowe has voted $40,000 in bonds to aid the project. We are informed that the construction is to be commenced early in the spring. Pres., P. D. Pike; Vice-Pres., C. L. McMahon, Stowe, Vt.

BOSTON, MASS.—H. B. Day, F. R. Cutter, C. I. Travelli, and Geo. H. Ellis, of West Newton, are interested in a new electric railway company, with a capital stock of $45,000, which proposes to construct a street railway on Commonwealth Ave. Boulevard from Auburndale to the Chestnut Hill reservoir.

SPENCER, MASS.—The Warren, Brookfield & Spencer Ry. Co. has been organized to build an electric railway between West Warren and Spencer, a distance of fifteen miles; capital stock, $200,000, of which about $100,000 has been subscribed. The Worcester Construction Co., it is reported, will build the road for about $14,000 a mile, and will also build the power house and furnish 14 cars. Hiram P. Gerald, I. L. Currier, of Worcester; John H. Mulcahey, G. H. Coolidge, of West Brookfield, and Alvin Hyde and W. G. Keith, of East Brookfield, are interested.

PAWTUCKET, R. I.—The Old Colony St. Ry. Co. has petitioned for articles of incorporation; L. B. Goff, Henry F. Barrows, Edward R. Price and C. L. Watson are interested.

NORWALK, CONN.—Press reports state that an agreement has been reached by which the New York, New Haven & Hartford R. R. Co. will obtain a controlling interest in the Westport & Saugatuck Horse R. R. Co., provided a charter to equip it with electricity can be secured. If the present plan matures the road will be entirely rebuilt, equipped with electricity, and extended to Lyons Plains. The Norwalk Tramway Co. is also included in the deal, which will result in connecting the two lines, as at present planned.

BATAVIA, N. Y.—Press reports state that all the rails have been ordered for the electric railway, which will probably be in operation by July.

BROOKLYN, N. Y.—The Brooklyn Elevated R. R. Co. is reported about to repaint six miles of its structure, and also to repaint a number of its stations. The work will begin about April 1.

BUFFALO, N. Y.—We are informed that an electric road is to be built between this city and Ebenezer. Work will be begun within a month. It will cost about $40,000. Charles Schoepflin, Assessor Witzig, Isaac Taggart, H. D. Kirkover and others are interested. A company will be incorporated immediately.

COHOES, N. Y.—Bids are asked by the Cohoes City Ry. Co. until March 22 for constructing the roadbed for an extension to its electric road.

FISHKILL, N. Y.—The Fishkill Electric Ry. Co. has been incorporated to build a railway from Matteawan to this place; capital stock, $50,000; directors, John T. Smith, E. K. Tompkins and B. L. Smith, of Fishkill; W. H. Southard, of Matteawan, and W. H. Weston, of Newburg.

GREENBUSH, N. Y.—The Albany & Suburban St. R. R. Co. has petitioned for a franchise. F. R. Barnes is interested.

HEMPSTEAD, N. Y.—The Long Island Electric Ry. Co. has petitioned for a franchise for its road on several streets to Far Rockaway, and from East Rockaway to Freeport.

LOCKPORT, N. Y.—Horace E. Deming, representing C. A. Johnson, of New York, has petitioned for a franchise for a street railway.

NEWTOWN, N. Y.—E. B. Gallaher, Ch. Engr., 253 Broadway, New York, writes us that all rights of way have been secured and surveys made for the Brooklyn, Newtown & Bowery Bay electric railway, which will be eight miles in length. The company has secured 66⅔ of the capital for the construction, and as soon as the entire amount has been secured contracts will be awarded. Pres., A. C. Combes, Newtown.

NEW YORK, N. Y.—The North New York Junction Ry. Co. has petitioned for a franchise for its road on several streets. Pres., John Cotter.

NEW YORK, N. Y.—The residents of Washington Heights have appointed J. H. Caryl, E. B. Griffin, Geo. B. McVey and others a committee to urge the extension of the Manhattan Elevated R. R.

NIAGARA FALLS, N. Y.—The Niagara Falls & Lewison R. R. Co. has petitioned for permission to extend its road on four streets.

STAPLETON, N. Y.—The Midland R. R. Co. has secured a franchise to change its motive power to electricity, and the Staten Island Interior Electric Ry. Co. has secured a franchise for rebuilding its entire road. Erastus Wiman is interested in the latter company.

IRVINGTON, N. J.—The Clinton township committee has granted the New York & Philadelphia Traction Co. a franchise on Springfield Ave.

PRINCETON, N. J.—The New York & Philadelphia Traction Co. has been granted a franchise for its electric road on several streets.

DOYLESTOWN, PA.—An electric railway is to be be built from this place to Newton, a distance of 16 miles, as soon as the weather permits, according to reports. William Fell, of Philadelphia, Pres. Bucks County Electric Ry. Co., is interested.

McKEESPORT, PA.—The McKeesport, Wilmerding & Duquesne St. Ry. Co. has been granted right of way for an extension of its electric road, work on which will probably commence in a few days. Gen. Man., C. Devenny.

PITTSBURG, PA.—The Second Ave. Traction Co. is considering an extension of its electric road from McKeesport to Elizabeth, a distance of 23 miles, according to reports.

BALTIMORE, MD.—Bids are asked by the Baltimore, Severn Park & Annapolis R. R. Co. for the construction of an electric railway 28 miles in length, according to reports. Ch. Engr., Henry Y. Bready, Chesapeake Bank Bldg.

WASHINGTON, D. C.—A correspondent writes us that the Washington & Great Falls Electric Ry. Co. is about ready to award contracts. The completion of surveys for this road was noted in our issue of March 7. Ch. Engr., T. Styer.——The Washington & Marlboro Electric R. R. Co. is making financial arrangements for the construction of its road into this city, work on which will begin as soon as possible. Pres., A. Meisy. Chas. E. Coffin, R. V. Hall and J. T. Perkins are among those interested.——The Takoma, Burnt Mills & Sandy Springs Electric R. R. Co. is planning to extend its road from the district line to Sandy Springs. Enoch Maris is interested.

PARKERSBURG, W. VA.—The Parkersburg Traction Co. was incorporated March 14 with a capital stock of $1,000,000, of which $200,000 is paid in; incorporators, D. B. Judd, Wm. R. Hurd and Wm. C. Spring, of Bristol, Conn., and H. P. Canden and John G. Hogan, of Parkersburg.——Press reports state that the American Construction Co., of Boston, Mass., has purchased the Park City St. Ry., of this city, which it intends changing into an electric system. Work on the improvements will begin in about two weeks, to be completed within seven months. The estimated cost of the change is $350,000.

NEW ORLEANS, LA.—The Orleans R. R. Co. has voted to issue $300,000 in 6% bonds for equipping its road with electricity, and as soon as the bonds are sold work will begin. Secy., L. M. Petitpain.

BOWLING GREEN, KY.—It is reported that contracts will soon be awarded for constructing an electric railway five miles in length. M. H. Crump, Secy. Commercial Club, is interested.

CLEVELAND, O.—The Cleveland Electric Ry. Co. has issued $100,000 in bonds to purchase 30 new cars, contract for which will soon be awarded, to construct 40 new motors, and to extend its road one mile on Broadway.

TOLEDO, O.—Press reports state that a company is being organized to build an electric railway from Toledo to Sylvania, thence through Fulton and Williams counties to a point near the state line. Right of way for almost the entire line has already been secured. It will go through the towns of Sylvania, Wauseon, Archbold, Bryan, Metamora, Lyons, and several other small places. Geo. W. Acker, of Toledo, is interested.

WARREN, O.—The Mahoning Valley Electric Ry. Co. has not yet awarded the contracts for the construction of its road from Niles to Youngstown, by way of Girard, a distance of 9 miles. We are informed that the right of way has been secured and franchise granted. The road is to be completed by Sept. 1. Pres., C. F. Clapp, Warren.

BAY CITY, MICH.—The Inter-Urban Ry. Co. has been incorporated to build a street railway from Bay City to West Bay City; capital stock, $200,000, with $16,000 paid in; incorporators, F. E. Snow, J. H. Nicol, Wm. A. Jackson, of Detroit, and Isaac Bearinger and W. J. Hart, of Saginaw.

DETROIT, MICH.—The Detroit & Mount Clemens Electric R. R. Co. has awarded the contract for constructing and equipping its road with electricity, and the construction of the road has been sub-let to Geo. E. Currie, of Detroit. M. Blay & Son have the contract for constructing the power house, upon which work has begun.

LUDINGTON, MICH.—The Epworth League Ry. Co. has been incorporated to build a street railway from this place to Hamilton Lake; capital stock, $15,000, with $4,500 paid in; Geo. N. Stray, Frank Flen and John Joyce are the incorporators.

CHICAGO, ILL.—The Lake St. Elevated R. R. Co. has secured permission from the town of Cicero to extend its road from the city limits to the limits of Cicero, a distance of 2½ miles. Stations are to be built every half-mile, and the work completed in 20 months.

OMAHA, NEB.—The construction of an electric railway from the terminus of the present street railway lines in this city to Fremont is proposed. J. H. Pratt and Frank Hibbard, of Irvington, are interested.

CARTHAGE, MO.—The Joplin & Galena Electric Ry. Co. has been incorporated, with a capital stock of $120,000, with $60,000 paid in; incorporators, E. Z. Wallower, R. A. Johnson and N. Hamilton, of Harrisburg, Pa.; A. H. White and D. C. Hoover, of Joplin; H. H. Harding, of Carthage, and J. M. Maret, of Webb City. Most of these are interested in the Inter-Urban Electric Ry. between Webb City and Joplin.

ST. LOUIS, MO.—The Pine St., Kirkwood & Northwestern Ry. Co. has been incorporated with a capital stock of $8,000 by A. H. Eilers, James F. Brady and Jeremiah Ryan.——The St. Louis, Kirkwood & Northwestern R. R. Co. has been incorporated to build an electric road about 40 miles in length; capital stock, $5,000; incorporators, August H. Eilers, James F. Brady, and Jeremiah Ryan.——The Delmar Ave. & Clayton Ry. Co. has been incorporated to build an electric road from the city limits to Clayton.——The Citizens' Ry. Co. has awarded contracts for reconstructing its electric road, work on which will begin between April 1 and 15. Gen. Man., Robert McCulloch.——The King's Highway R. R. Co. has been incorporated, with a capital stock of $2,000; incorporators, Festus J. Wade, John C. Kerrey, and Geo. W. Wilson.

AUSTIN, TEX.—The Austin Dam & Suburban Ry. Co. has been incorporated to build a street railway; capital stock, $100,000; incorporators, Frank Hamilton, John H. Chiles, Carl F. Drake and Henry M. Metzger.

DENISON, TEX.—It is reported that the street railway has been sold and will be equipped with electricity. Geo. L. McLagan and W. F. Haven are interested.

WAXAHACHIE, TEX.—The Lake Park St. R. R. Co. has been incorporated, with a capital stock of $5,500; incorporators, Wm. F. Lewis, J. F. Strickland, S. F. Langsford and V. H. Shelton.

LOS ANGELES, CAL.—The Los Angeles Consolidated Electric Ry. Co. has voted to change the motive power from cable to electricity and make a number of improvements. Thomas Brown, Lovell White and A. H. Payson have been appointed a committee to carry out the plans.

CARLETON PLACE, ONT.—A company has been organized to construct an electric railway between Napierville and Remi, Que., a distance of 12 miles, and another road from Lanark to Perth. James Fowler is interested, according to reports.

HALIFAX, N. S.—A company has been formed to construct an electric railway in this city. John Y. Payzant, Adam Burns, and W. B. Ross, of Halifax; Henry M. Whitney, of Boston, Mass., and James Ross, Man. Dir. Montreal St. Ry. Co., are interested.

## ELECTRIC LIGHT AND POWER.

GREEN ISLAND, N. Y.—A committee, consisting of D. E. Tighe, T. H. Richardson, Geo. A. Van Bergen and others, has been appointed to consider the securing of a site for an electric light plant.

LOCKPORT, N. Y.—A bill has been introduced in the legislature authorizing the city to vote on a proposition to issue $25,000 in bonds to purchase the electric light plant.

CHESTER, PA.—Bids are asked until April 1 for lighting the city with electricity for five years. James B. Campbell, Clk.

PHILADELPHIA, PA.—Bids are asked until March 29 for incandescent and arc electric light plants, boilers, telephones, electric bells, burglar alarms, etc., and elevators, for the Philadelphia County Prison. Archs., Wilson Bros. & Co., Drexel Bldg.; Edmund Smith, Pres. Dept. Prisons.

BALTIMORE, MD.—The committee on almshouse has recommended an appropriation of $5,000 or $6,000 for an electric light plant for the Bayview asylum.

FROSTBURG, MD.—Bids are asked for a 50-HP. engine, 500 to 1,000-light dynamo, etc., according to reports. J. G. Schofield.

VERSAILLES, KY.—The council has passed an ordinance for the construction of an electric light plant of 30 1,200 c. p. lights. The committee has been authorized to secure bids at once, according to reports.

MONTPELIER, O.—The citizens are reported as soon to vote on a proposition to issue $33,000 in bonds for an electric light plant and water-works system.

WADSWORTH, O.—An electric light company has been organized and a plant will be put in as soon as possible. Pres., J. S. Oberholtzer.

SHELBYVILLE, ILL.—Trout Bros. have been granted a franchise for an electric light plant.

MILWAUKEE, WIS.—Bids are asked by the department of public works until April 6 for putting an electric light plant and for installing the electric light fixtures in the new city hall.

AITKEN, MINN.—This village has voted to issue bonds for an electric light plant.

MANKATO, MINN.—The construction of a municipal electric light plant being considered by the council, according to reports.

CASCADE, IA.—An electric light plant will probably be put in at this place, according to reports.

TOPEKA, KAN.—The Topeka Water & Electric Power Co. has been granted a franchise for the erection of a dam across the Kansas River, to supply this city with 4,200 HP., and also for lighting it. Work will begin in about three months. T. E. Bowman is interested.

RANDOLPH, NEB.—It is reported that this place is soon to have electric lights.

ST. LOUIS, MO.—The County Electric Light & Power Co. has been granted a franchise.

WEBB CITY, MO.—Bids are asked until March 25 for equipping an electric light plant. Owen Ford, 710 Security Bldg., St. Louis; C. J. McCleland, Cy. Clk.

LOVELAND, COLO.—J. F. Alexander has been granted a franchise for an electric light plant, work on which will begin in a few days.

NIAGARA FALLS, ONT.—The electric light company has petitioned for a 10-year extension to its franchise, which expires in three years. The company is considering the question of greatly improving the plant and securing power from the American side of the river.

NEW COMPANIES.—Yankton Electric & Mfg. Co., Yankton, S. Dak.; $40,000; John McGregor, Otto R. Brandt, F. H. Evans.

Wellsville Electric Light Co., Wellsville, O.; $30,000; Homer Laughlin, W. E. Wells, R. L. Andrews, Julius Goetz, H. C. Wells.

Consolidated Water Power Co., Grand Rapids, Wis.; $300,000, with $150,000 paid in.

Bridge Mill Power Co., Pawtucket, R. I.; to generate electricity; Darius L. Goff, Geo. M. Thornton.

Central Electric Co., Le Sueur, Minn.; $25,000; Wm. H. Patten, H. Tomlinson, H. F. Weist, E. H. McLeod.

Kansas Telephone & Electrical Co., Parsons, Kan.; $40,000; A. B. Kirlen, D. L. Stewart, C. W. Regan, W. M. Busby.

People's Electric Light & Power Co., Calais, Me.; $50,000, with $800 paid in; Pres., John G. Murchie; Treas., Ashley St. Clair.

Chase Electric Cyclorama Co., Chicago, Ill.; $100,000; to build a photographic cyclorama, with a battery of improved stereopticons, the electrical installation to cost $15,000; Chas. A. Chase, D. W. McCaughey, Geo E. West.

## BRIDGES.

LISBON, ME.—The town has voted to build an iron bridge between Lisbon Falls and Durham.

LOWELL, MASS.—The construction of a county bridge over the Merrimac River, between Tyngsboro and Chelmsford, estimated to cost $100,000 to $175,000, is being considered by the legislative committee on roads and bridges.

CARTHAGE, N. Y.—The governor has signed a bill appropriating $25,000 for building a bridge over the Black River Canal, between this place and West Carthage.

FENTON, N. Y.—An election will be held March 21 to vote on the question of an appropriation for building an iron bridge at Port Crane.

GLOVERSVILLE, N. Y.—Bids are asked until April 1 for constructing an iron bridge 48½ ft. wide at Bleecker St. E. B. Baker, Cy. Engr.; F. H. Wilmarth, Cy. Clk.

HAMBURG, N. Y.—The town has voted to appropriate $4,000 for the construction of a bridge at Water Valley.

STAPLETON, N. Y.—The construction of an iron drawbridge over Fresh Kills, to connect Northfield and Westfield, is being considered by the supervisors.

PHILADELPHIA, PA.—Plans have been prepared by

J. G. Dagron for a $300,000 bridge across the Schuylkill River for the Fairmount Park electric railway, which was granted a franchise some time ago. The bridge will be 1,180 ft. in length, 80 ft. in width, 84 ft. above the water, and have eight piers, five of which will be in the river.——Press reports state that the Franklin Sugar Refining Company has filed plans with the board of port wardens for the construction of a pier in the Delaware River. The pier will be 548 ft. long, 75 ft. wide, and will be built in 40 ft. of water. It will be the first pier constructed in this city with an iron superstructure above the railing. There will be 1,660 piles driven, upon which the iron superstructure will be erected. The pier will be located between South and Bainbridge Sts., and will be known as No. 28. It will take the place of the present piers 27, 28 and 29, and will be three times the length of those now in use.

PITTSBURG, PA.—The Marietta Bridge Co. has been incorporated in West Virginia to build a toll bridge across the Ohio River at Marietta, O.; capital stock, $500,000, with $5,000 paid in; incorporators, H. H. Swaney, McKeesport; T. S. White, New Brighton; W. C. Jutte, and G. W. Theirs, of Pittsburg.

MONTEVALLO, ALA.—The county commissioners have ordered the construction of a steel bridge across Shoal Creek, 100 ft. in length, with a roadway 16 ft. in width.

BELLEVILLE, ILL.—It is proposed to construct a bridge across Richland Creek, on West Main St., estimated to cost $10,000.

WEST SUPERIOR, WIS.—Press reports state that A. T. Thomas, Cy. Engr., is in receipt of plans and specifications for the viaduct which the Great Northern Ry. Co. will build on Belknap St., over its network of tracks. The specifications are not satisfactory to Mr. Thomas, and he will not approve them. The principal objection is that the bridge will be too light. It is calculated to accommodate a live load of 80 lbs. to the sq. ft. on the roadway and 60 lbs. on the sidewalks. The engineer will insist that the estimate be increased 20%.

HILLSBORO, TEX.—It is reported that the commissioners' court is negotiating with a bridge company for five new steel bridges in Hill county, and it is probable that at the next meeting of the court a contract to that effect will be entered into. The court has already established several new steel bridges.

## BUILDINGS.

BUFFALO, N. Y.—The trustees of the Emergency Hospital have decided to build a handsome brick structure for a new hospital opposite Bennett Park. The plans will be given to an architect within a few days.

HERKIMER, N. Y.—A. M. Evans, of Albany, is preparing plans for a two-story fireproof county clerk's office, with a vault in rear, estimated to cost $15,000.

NEW YORK, N. Y.—The Rhinelander estate, 54 William St., has filed plans for a 12-story brick printing house at 232 to 238 William St., to cost $200,000. ——The sinking fund commission has awarded the contract for the erection of a public building for the 23d and 24th wards to James O'Toole & Co., at $61,750.

ALTOONA, PA.—It is reported that the Edison Electric Illuminating Co. is to erect a $75,000 iron building at this place.

DENTON, MD.—Press reports state that the Caroline county court house commission has awarded the contract for building the new court house to Slemmons & Lankford, of Salisbury, at $17,383. The other bidders were: T. P. Johnson, Baltimore, $21,280; M. P. Flowers, Easton, $18,800; W. S. & A. M. Culp, Chestertown, $21,938.

WASHINGTON, D. C.—Bids are asked until April 2 for constructing a life-saving station on Core Bank, between Beaufort and Portsmouth, N. C. S. I. Kimball, Gen. Supt. Life Saving Service.

AUGUSTA, GA.—Press reports state that work on the new cotton factory to be built by the Aiken Mfg. Co. at Bath, six miles from Augusta, will be commenced at once. The new mill will be furnished with 15,000 spindles and 450 looms, and will be completed and ready for operation in about five months. It will give employment to 300 operatives. The Aiken Mfg. Co. has been organized with a capital stock of $400,000. Pres., F. B. Henderson; Treas., Charles Estes; Secy., L. L. Winters. The water power at the point selected for the factory is expected to develop 800 HP.

COLUMBUS, O.—The Union Depot Co. is considering the question of building a union station.

DAYTON, O.—The question of constructing a union station and elevating the railway tracks in this city is being considered by the railway companies and the city officials.

MANSFIELD, O.—Bids are asked by the Ohio state reformatory until April 10 for the iron gratings between the cell corridors, guard room and mess room; also around elevator opening and for a hydraulic elevator, for four flights of iron stairs leading to the chapel and hospital, and wrought plate doors. Arch., L. T. Schofield, Case Bldg., Cleveland.

TOLEDO, O.—A four-story brick high school building was destroyed by fire March 11; loss, $150,000.

TERRE HAUTE, IND.—Press reports state that a distillery, with a capacity of 10,000 bushels per day, is to be constructed at this place, at an estimated cost of $300,000. Geo. W. Kidd, E. C. Gaffield and Frank Curtis are interested.

DETROIT, MICH.—The following bids were received by the school board March 14 for the construction of a new high school building: **Mason specifications:** J. W. Cottrell & Co., Cincinnati, $195,760; John Finn, $224,287; Henry Carew & Co., $214,500; J. L. Gearing & Son, $229,956; H. George & Son, $213,790; F. H. Goddard, $226,500; A. Anderson, $205,300; Patrick Dee, $242,956; A. Chapoton, $224,340; Wm. S. Piggins, $241,455. **Carpenter specifications:** Albert Strelow, $108,965; John Whittaker & Co., $89,843; Vinton & Co., $85,800; M. Armstrong & Co., $82,500; Spitzley Bros., $81,500; J. W. Cottrell & Co., $81,740; E. Mayhew & Son, $82,444; Teakle & Golden, $97,672; J. L. Gearing & Son, $89,919; H. George & Son, $91,500. The bidders are all residents of Detroit except Cottrell & Co., of Cincinnati.

ST. LOUIS, MO.—Bids are asked until April 5 for the erection of five new school buildings. Louis J. Holthaus, Chn. Bldg. Com.

OLYMPIA, WASH.—The legislature has passed a bill appropriating $930,000 for continuing the work of building the capitol.

TORONTO, ONT.—Press reports state that a movement is now on foot to erect a $500,000 hotel at York and Wellington Sts. It will have a frontage of 180 ft. on Wellington and 140 ft. on York, and will be seven stories high. J. F. McKinnon, wholesale milliner, is the projector.

## WATER-WORKS.

LISBON FALLS, ME.—J. H. Brewster, A. E. Jordan and Chas. E. Appleby have been appointed a committee to secure plans and make investigations for works for the villages of Lisbon Falls, Lisbon, and Lisbon Center. The proposed system will probably cost $100,000, and it is reported that the citizens are much in favor of the project, which also includes a system of sewers. The town has appropriated $750 for the investigation.

NASHUA, N. H.—Bids are asked until April 10 for constructing a stone dam across Pennichuck Brook, as stated in our advertising columns. H. G. Holden, Supt.

PETERBORO, N. H.—John H. Steele, Town Clk., writes us that the water-works question has been postponed until the next annual meeting in March, 1896, for further report from committee.

CHELMSFORD, MASS.—At a town meeting March 18 a committee was appointed to consider the question of a water supply from certain ponds, with a reservoir on Robins Hill; committee to report in one year.

GROVELAND, MASS.—Efforts are being made to secure the construction of a reservoir near Perry Park.

MEDFORD, MASS.—Bids are asked until April 1 for laying a 20-in. main from Spot Pond to Wright's Pond, as stated in our advertising columns. Frank E. Chandler, Chn. Comrs.

NORTH BROOKFIELD, MASS.—It is reported that another town meeting will probably be held this week to vote on an appropriation to complete the works.

SHARON, MASS.—The town has voted to offer the Sharon Water Co. $30,000 for its franchise and works.

FARMINGTON, CONN.—A. R. Wadsworth, H. N. Whittlesey, Erastus Gay, and others have petitioned for a charter for the Farmington Water Co., with a capital stock of $30,000.

SOUTHPORT, CONN.—A bill has been introduced in the legislature incorporating the South Farms Water Co., to construct works at this place.

WILLIMANTIC, CONN.—The water committee has recommended the purchase of at least 100 new meters.

BROOKLYN, N. Y.—The Blythebourne Water Co., of Blythebourne, now a part of this city, has voted to increase its capital stock from $10,000 to $100,000.

FORESTVILLE, N. Y.—Bids are asked until April 5 for the purchase of $18,000 in 4% water bonds. Bids will be asked within a few days for the construction of works. S. W. Reynolds, Chn. Com.

LESTERSHIRE, N. Y.—The citizens are agitating the question of purchasing the works.

NEW HARTFORD, N. Y.—The New Hartford Water Co. has been incorporated to supply this place, Utica and Whitestown; capital stock, $100,000; directors, C. Lansing Jones, S. F. Sherman and Peter Crowe, of New Hartford, and I. N. Terry, G. E. Dunham, J. S. Sherman and Otto A. Meyer, of Utica.

RHINEBECK, N. Y.—Efforts are being made by the citizens to secure the construction of works.

SCHENECTADY, N. Y.—We are informed that the bill allowing the city to issue $215,000 in bonds for a new water supply has been signed by the governor, and the water commissioners are now negotiating with owners of land near the proposed site of the pumping station, near lock 23 Erie Canal. It is desired to get the pipe to the river under the canal before the water is let in, which will be about May 1. The intention is to let the contracts and get the work under way as soon as preparations can be perfected and the necessary plans and specifications are prepared.

TROY, N. Y.—Bids are asked until March 22 for furnishing and setting two horizontal return tubular steel boilers of 175 HP. Geo. B. Fales, Clk. Comrs.

ROCHESTER, N. Y.—There is talk of constructing a stand-pipe on Cobb's Hill.

ATLANTIC CITY, N. J.—The Supreme Court has refused to appoint new appraisers for the works, which are valued at $843,500. The city claims that this is much too high, and city officials are reported as stating that steps will be taken by the city at once to build new works.

ALLEGHENY, PA.—The contract for constructing the 60-in. steel riveted conduit has been awarded to T. A. & R. G. Gillispee, at $850,000, the other bids being as follows: William T. Dunn, $895,283; Shaller & Schniglau, $1,050,000; Sloman & McIlvaine and Otto Bros., $999,500; Booth & Flinn, $941,000; Benney & Co., $1,198,000; W. J. Hoffman & Co., $1,151,207; James McQuaid, $1,251,944; F. Gwinner, Jr., $1,090,366.

ALTOONA, PA.—The water department has been instructed to lay new pipes and to relay the present pipes in a large number of streets.

BRADDOCK, PA.—An election will be held June 14 to vote on an issue of $25,000 in bonds for a reservoir.

ERIE, PA.—Plans for the proposed extension of the intake 8,200 ft. are reported about completed.

GIRARDVILLE, PA.—The Oak Grove Water Co. was incorporated March 18, to supply water in West Butler township; capital stock, $5,000, commencing with $500; Treas., Z. T. Trout.

LANCASTER, PA.—The Martic Water & Power Co., and the Sowego Water & Power Co. were incorporated March 14; capital stock of each, $1,000, commencing with $100; Treas., C. Reynolds McConkey, Peach Bottom, Pa.

McKEESPORT, PA.—The committee investigating the question of a pure water supply has reported that the Monongahela River water, while better than the present supply, is not enough purer to be desirable as a supply, and some method of filtration is now being considered. It is reported probable that a supply will be secured from driven wells.

MEADVILLE, PA.—Bids are asked until March 27 for the construction of new works. W. R. Vance, Cy. Clk.

YORK, PA.—The Lower Chanceford Water & Power Co. has been incorporated with a capital stock of $1,000, commencing with $100; Treas., C. Reynolds McConkey, Peach Bottom.

BALTIMORE, MD.—Bids are asked until March 26 for a supply of gun metal castings. Wm. L. Kenly, Acting Ch. Engr.

WESTON, W. VA.—It is stated that plans and specifications have been completed for works, including iron tank and 15,000 ft. of 6 and 4-in. mains.

MARION, N. C.—The legislature has authorized the town commissioners to use the bonds now in the town treasury to put in a system of gravity water-works.

MONTEZUMA, GA.—The contract for two artesian wells has been awarded to A. H. Wooten, of Wadley.

ROME, GA.—It is stated that an $8,000 filter plant is needed for the new works.

JACKSON, MISS.—William T. Wilcox, Supt., writes us that bids will be asked about April 15 for a new pump, estimated to cost $3,500.

MORRISTOWN, TENN.—It is reported that bids are being received for the construction of works. Address R. F. Taylor.

CELINA, O.—Bids are asked until April 10 for the construction of works, as noted in our advertising columns (postponement of date from April 4). Engrs., Voorhees & Witmer, Buffalo. J. P. Le Blond, Pres. Trustees.

CLEVELAND, O.—Bids are asked until April 1 for about 149 ft. of 30-in. wrought steel water pipe, including two curves of 18° and one curve of 14°. J. H. Farley, Dir. Pub. Wks.

HICKSVILLE, O.—It is stated that an election will be held next month to vote on an issue of $10,000 in bonds for extending the works.

MILLERSBURG, O.—The question of issuing $20,000 in bonds for works will be voted upon April 1, according to reports, which state also that the proposition will probably carry.

MONTPELIER, O.—An election will soon be held to vote on an issue of $33,000 in bonds for works and an electric light plant.

TOLEDO, O.—T. R. Cook, Supt., writes us that a contract for 1,000 tons of cast iron pipe has been awarded to the Buckley Supply Co., but that at the request of the bidders the prices are not made public.

VERMILION, O.—An election will be held April 1, according to press reports, to vote on an issue of $20,000 in bonds for water-works.

WAPAKONETA, O.—The city is reported to have sold $50,000 in water bonds for $52,350.

SOUTH WHITLEY, IND.—The town has voted to issue $15,000 in bonds for works, which, it is stated, will be put in as soon as possible.

HUDSON, MICH.—It is stated that a proposition to issue $6,000 in bonds for extensions will soon be voted upon.

GRAND RAPIDS, MICH.—W. R. Coats read a paper at a recent meeting of the board of trade on the advisability of securing a water supply from Thornapple River.

HOWARD CITY, MICH.—It is stated that the citizens will vote at the coming election on an appropriation of $2,000 for extending the works.

LAKE VIEW, MICH.—Bids are asked for the construction of works. E. B. Stebbins, Secy. Com.

CANTON, ILL.—Bids are asked until April 2 for sinking an artesian well, as stated in our advertising columns. A. Hering, Chn. Com.

CHICAGO, ILL.—The Holly Mfg. Co. has been awarded the contract for the five pumping engines for which bids were asked some time ago.

CHICAGO, ILL.—The council has appropriated $150,000 for water supply extensions.

FREEBURG, ILL.—The village trustees are reported to have decided to dig a well in the square and to erect a windmill and tank for fire protection.

KNOXVILLE, ILL.—Bids are asked until April 8 for pumping machinery and fire pump, as stated in our advertising columns. Consult. Engr., Chas. F. Sturtevant, St. Louis. L. M. Smith, Cy. Clk.

MAYWOOD, ILL.—Bids will soon be asked for laying water mains, etc. Samuel H. Donaldson, Jr., Village Clk.

OCONOMOWOC, WIS.—The city clerk writes us that the water-works proposition was voted down by the council March 4.

COLUMBUS JUNCTION, IA.—The citizens have voted by a majority of two to issue $10,000 in bonds for works.

LIVERMORE, IA.—The citizens have voted to issue bonds for works.

HOLTON, KAN.—The Holton Gas, Oil, Mineral & Water Co. has been incorporated with a capital stock of $8,000. The directors include J. B. Gardner, G. E. Locke, V. J. Hoffman and others.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until March 26 for a supply of pipe, castings, valves, etc.; also for pipelaying.

SPRINGFIELD, MO.—The business men of Commercial St. are trying to organize a company for the purpose of sinking an artesian well. It is thought that a 6-in. well can be put down to a depth of 1,000 ft. for $2,500.

BIG SPRINGS, TEX.—The Big Springs Water Co. has been incorporated with a capital stock of $30,000. H. H. Allison is interested.

COLEMAN, TEX.—Bids are asked by the city clerk until April 8 for the purchase of $15,000 in 40-year water bonds.

DALLAS, TEX.—The contract for constructing the wooden conduit has been awarded to Sonnefield & Emmins.

FARMERSVILLE, TEX.—The city wishes to grant a franchise. Dr. A. H. Neathery, Chn. Com.

MORGAN, TEX.—It is stated that new works will soon be put in; supply from an artesian well to be sunk north of the village.

SAN ANTONIO, TEX.—The superintendent writes us that all materials for the proposed extensions have been purchased, and that the work will be done by day labor.

SHERMAN, TEX.—We are informed that two additional boilers and two miles of mains will be added. Engr., A. Q. Nash. Wm. Tolson, Official in Charge.

WEATHERFORD, TEX.—Bids are asked for boring a well 400 ft. deep for the works. W. S. Fant, Receiver.

LOS ANGELES, CAL.—The council has passed an ordinance for an election to vote on six propositions, one being for an appropriation of $30,000 for acquiring land for the construction of head works for a water system for the city.

SAN DIEGO, CAL.—The Southern California Mountain Water Co. has been incorporated with a capital stock of $3,000,000, commencing with $350,000; incorporators, Harry L. Titus, J. Clyde Hizer, Anna M. Waterman, M. H. Titus and Charles Pleasants, all of San Diego.

WESTVILLE, N. S.—Bids are asked until April 15 for the construction of works. Geo. E. Monro, Mayor. ——Bids are asked until April 10 for the purchase of $60,000 in water bonds. Alex. W. D. Bean, Town Clk.

TORONTO, ONT.—The city engineer estimates that nearly $1,500,000 will be required for public work during 1895, including $153,510 for water-works maintenance, $98,045 for construction, $226,000 for fire pressure mains, $75,000 for 6-ft. steel intake and $450,000 for water tunnel across the bay.

### IRRIGATION.

PASCO, WASH.—It is reported that a company has been formed at this place to reclaim 2,700 acres of land near Snake River. Power will be secured at Five Mill Rapids to pump water to a bluff 100 ft. high. E. P. Kuhl is interested.

STOCKTON, CAL.—Press reports state that J. D. McDougald, of this city, has been awarded the contract for completing the irrigation canal for the Stanislaus & San Joaquin Co., from Knight's Ferry to Burnett's Station, on the line of the Stockton & Merced R. R., a distance of 11 miles. He will also complete the remaining tunnel, which lacks 36 ft. of being finished. The tunnel is 11 ft. wide and 12 ft. high. The contract will amount to about $25,000. The irrigation company promises to bring Stanislaus River water to Lathrop by June.

NEW COMPANIES.—Uvalde Irrigating, Agriculture & Horticultural Co., Uvalde, Tex.; $5,000; John Wymetter.

North, Middle & South Tules Drain, Land & Irrigation Co., Tulia, Swisher county, Tex.; $30,000.

Barton County Irrigation Co., Great Bend, Kan.; $300,000; to construct dams and canals for irrigation; J. V. Brinkman, G. L. Chapman, Chas. E. Dodge.

### SEWERAGE.

LISBON FALLS, ME.—J. H. Brewster, A. E. Jordan and Chas. E. Appleby have been appointed to secure plans for sewers and water-works.

NORWAY, ME.—J. O. Crooker, Chn. Selectmen, writes us that no contracts have been made, and no money yet raised for sewers.

EXETER, N. H.—McClintock & Woodfall, of Boston, have prepared plans for the improvement of the system.

BELMONT, MASS.—We are informed that the contract for constructing a sewer was awarded to Weaving, Booth & Parry, and that the work is about half completed. Engr., E. A. W. Hammett, 29 Pemberton Sq., Boston; W. L. Chenery, Town Clk.

BROCKTON, MASS.—The council has authorized an issue of $250,000 in bonds for sewer construction this year. F. Herbert Snow, Cy. Engr.

FAIRHAVEN, MASS.—The legislature has passed a bill authorizing the construction of a system.

MALDEN, MASS.—The aldermen have voted to issue $150,000 in bonds for main sewers.

MEDFORD, MASS.—Bids are asked until March 30 for furnishing 360 cast iron manhole frames, and for constructing 20,477 ft. of pipe sewers., etc. T. Howard Barnes, Cy. Engr.; John D. Street, Chn. Comrs.

NEW BEDFORD, MASS.—Bids are asked until March 27 for the purchase of $58,000 of 30-year 4% sewer bonds, and $24,000 of 4% improvement bonds. David L. Parker, Mayor; James H. Hathaway, Cy. Treas.

WEST NEWTON, MASS.—Bids are asked until March 28 for 5,000 bbls. of cement, as stated in our advertising columns. Henry D. Woods, Cy. Engr.

BRISTOL, CONN.—We are informed that the contract for constructing a system has not yet been awarded, and that the bids will not be made public. Miles L. Peck, Warden.

MERIDEN, CONN.—About six miles of pipe sewers are to be constructed this year, for which local labor only will be used. E. B. Most, Cy. Engr.

ROCKVILLE, CONN.—It is stated that S. M. Gray, of Providence, has been engaged to design a system.

DUNKIRK, N. Y.—The council is considering a resolution for constructing sewers in four streets.

FULTON, N. Y.—The commissioners have recommended the early construction of a complete separate system. Engr., Reeves Smith, of Troy; Arvin Rice, Clk.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until March 28, for constructing a sewer in Denman Place.

PLATTSBURGH, N. Y.—Bids are asked until April 6 for extending the system at the Plattsburgh Barracks. Capt. Geo. E. Pond, U. S. A.

WATERTOWN, N. Y.—The completion of a sewer, at an estimated cost of $75,000 to $80,000 is being considered by the council.

WESTCHESTER, N. Y.—The legislature has been petitioned for authority to construct a system.

WILLIAMSBRIDGE, N. Y.—It is reported that arrangements are being made for a system.

HOBOKEN, N. J.—Bids are asked until March 27 for a brick sewer in Adams St., between 6th and 8th Sts., and in Grand St., between 7th and 8th Sts. M. V. McDermott, Cy. Clk.

JERSEY CITY, N. J.—A bill has been introduced in the legislature for the appointment of a commission to consider plans for the general sewerage of the Passaic Valley.

NEWARK, N. J.—Bids are asked until March 28 for constructing 3,170 ft. of 15 to 10-in. pipe sewers in two streets. J. C. Mundy, Gen. Supt.

TRENTON, N. J.—Plans are being prepared by Rudolph Hering, of New York, for the extension of the system in two wards.

WESTFIELD, N. J.—Bids are asked until April 9 for constructing a system of sewers, as stated in our advertising columns. Engr., F. A. Dunham, Plainfield, N. J.

OSCEOLA, PA.—It is reported that a system is to be constructed. W. W. Boone is interested.

SCRANTON, PA.—The ordinance for the construction of a system, estimated to cost $36,000, on the south side, has passed the council.

STEELTON, PA.—Plans have been prepared for a system, estimated to cost $53,000, according to reports.

KENSINGTON, MD.—A committee consisting of R. B. Detrick, B. H. Warner, J. L. Lewis and J. F. Stack, has been appointed to consider plans for a system, to drain into Rock Creek.

WASHINGTON, D. C.—The district commissioners have ordered the construction of sewers in seven streets, estimated to cost about $5,000.

MANCHESTER, VA.—Steps are being taken by the council to commence the construction of a system 17 miles in length. Engr., Edwin Mitchell.

AUGUSTA, GA.—The council has passed ordinances for constructing pipe and brick sewers in three streets, estimated to cost about $2,600. P. S. North, Clk.

OPELIKA, ALA.—H. J. Bandy writes us that nothing positive has yet been decided regarding sewers, but there may be something definite done within 12 months.

CINCINNATI, O.—Bids are asked by the board of administration until April 10 for constructing sewers in Delhi Pike.

ELWOOD, IND.—The council has voted to construct a sewer 6,000 ft. in length, estimated to cost $82,000.

GREENFIELD, IND.—The common council has engaged Phillips & Goss, Martinsville, Ind., to make surveys and prepare plans for a complete sewerage system, plans to be ready June 1, 1895.

CHICAGO, ILL.—W. S. Jones, of the town of Cicero, is preparing plans for converting the Des Plaines River into a sewer for a distance of 17 miles, at an estimated cost of $500,000, or at a total cost of $1,400,000, including proposed roadway, bridges, etc.

GROSSDALE, ILL.—The village board is reported to have ordered the construction of the proposed system, which will require about 30 miles of pipe sewers. Engrs., Hill & Enright, Chicago.

PEKIN, ILL.—Harman & Evans, of Peoria, are preparing plans for a system about 40 miles in length.

PEORIA, ILL.—Bids are asked until April 11 for furnishing all material and constructing the West Bluff sewer system, as described in our advertising columns. Isaac Taylor, Comr. Pub. Wks.

MILWAUKEE, WIS.—The board of public works has recommended the construction of pipe sewers in 20 streets.

OCONOMOWOC, WIS.—The city clerk writes us that the proposition to construct a system has been defeated by the council.

DAVENPORT, IA.—Bids are asked until March 30 for constructing a 15-in. pipe sewer in one street. E. W. Boynton, Comr. Pub. Wks.

INDEPENDENCE, MO.—This city has been granted authority to build a main sewer.

ST. LOUIS, MO.—Bids are asked until April 5 for constructing about 40,000 ft. of brick and pipe sewers. Emory S. Foster, Secy. Bd. Pub. Improvements.

SHERMAN, TEX.—We are informed that the construction of a system is contemplated. Wm. Tolson.

ONTARIO, CAL.—The trustees have sold bonds for a system, work on which will commence as soon as possible.

### GARBAGE DISPOSAL.

BRIDGEPORT, CONN.—The "News" states that the Hotaus system of garbage disposal will be used in this city, a representative of the firm having explained its method to the board of health and offered to erect a plant for $65,000. The plant is to be erected within eight weeks and the company asks for a contract for 15 years.

NEW YORK, N. Y.—The International Reduction Co. has been incorporated to treat garbage, etc.; capital stock, $200,000; directors, John B. Campbell, Brooklyn; R. W. Welling and G. S. Howe, New York.

YORK, PA.—The sanitary committee of council has awarded contracts for collecting garbage as follows: Francis Kelley (two districts), Wm. Hubley, Jacob Ilgenfeltz, Fred. Bartels, Henry Schleeder and Cornelius Fisher.

CHICAGO, ILL.—Bids are asked until March 22 for furnishing all wagons, labor, etc., for the collection and removal of garbage, ashes and rubbish from April 1 to Dec. 31, 1895. John McCarthy, Comr. Pub. Wks.

### STREETS AND ROADS.

NEW BEDFORD, MASS.—The question of street paving is being investigated, and it is thought that asphalt will be given a trial.

SPRINGFIELD, MASS.—The street committee has recommended that several streets be paved with granite blocks.

BROOKLYN, N. Y.—Bids are asked until April 2 for paving portions of seven streets with cobblestones and seven streets with second-hand Belgian blocks. A. T. White, Comr. Cy. Wks.

NEW DORP, N. Y.—The contract for macadamizing the Amboy road between this village and Giffords has been awarded to Joseph Hastings, at $22,597.

NEW YORK, N. Y.—Bids are asked until April 15 for paving on dikes in the Hudson River. Lieut.-Col. G. S. Gillespie, U. S. Engr. Office.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until March 26, for paving two streets with granite blocks and for grading two streets, and until March 28 for supply of broken stone.——A bill has been introduced in the legislature authorizing an issue of $3,000,000 bonds for additional paving work in this city.

TROY, N. Y.—A bill has been introduced in the legislature authorizing this city to issue $80,000 in bonds for additional paving.

NEWARK, N. J.—Bids are asked until March 28 for 1,000 lin. ft. of flagging in Lincoln Park. J. C. Mundy, Gen. Supt. Wks.

PATERSON, N. J.—Bids are asked until April 1 for grading and macadamizing nine streets and roads in this county. David F. Duncan, Chn. Freeholders.

TRENTON, N. J.—Bids are asked until April 2 for paving West State St., from Willow St. to Calhoun St., with brick. C. Edward Murray, Cy. Clk.

BALTIMORE, MD.—Ordinances have been introduced in the council for a large number of street improvements.

WASHINGTON, D. C.—Bids are asked by the district commissioners until March 25 for a supply of granite curbing.——Bids are asked by the bureau of yards and docks, navy department, until March 30, for paving east dry dock pier and approaches with granite blocks at the League Island navy yard. D. O. Matthews, Chf. of Bureau.

ATLANTA, GA.—The Fulton county commissioners have been petitioned to authorize the construction of a highway. John T. Cooper, Clk. Comrs.

ATHENS, O.—Bids are asked until April 13 for the purchase of $100,000 of 5% road improvement bonds. A. J. Frame, County Audr.

CINCINNATI, O.—The board of administration has adopted resolutions for paving 18 alleys with brick with granite curbing.

NEWARK, O.—Bids are asked until April 6 for paving First St. W. A. Irvine, Cy. Clk.

TOLEDO, O.—Bids are asked until March 26 for the purchase of $29,000 of 5% street improvement bonds. J. H. Pheatt, Cy. Audr.

SPRINGFIELD, O.—Bids are asked until April 12 for paving West High St. with brick. S. J. Wilkerson, Cy. Clk.

WINTON PLACE, O.—Bids are asked until April 2 for constructing artificial stone sidewalks in two streets. R. B. Poage, Village Clk.

WOOSTER, O.—Bids are asked until April 5 for improving two streets. B. F. Eason, Clk.

ELKHART, IND.—Bids are asked until April 3 for paving one street with brick. C. L. Kinney.

FORT WAYNE, IND.—Specifications are being prepared for paving 10 alleys. A. J. You, Clk. Bd. Pub. Wks.

INDIANAPOLIS, IND.—The board of public works has ordered plans prepared for paving North Meridian St. with sawed red cedar or white pine blocks 5 ins. in depth on a 6-in. concrete foundation, with 1 in. of sand cushion.

TIPTON, IND.—A correspondent writes us that the city council has ordered the construction of 5,000 lin. ft. of brick pavement on a stone foundation, with brick and cement sidewalks, in the business part of the city. L. Vernon Gould is city engineer.

AVERYVILLE, ILL.—Bids are asked until April 5 for 25,150 sq. yds. of brick paving in Galena Road, as stated in our advertising columns. Engrs., Harman & Evans, Peoria, Ill. E. M. Moore, Village Clk.

EVANSTON, ILL.—Bids are asked until March 26 for grading and paving with macadam and cedar blocks; three contracts. H. S. Maddock, Comr. Pub. Wks.

MAYWOOD, ILL.—Sam'l H. Donaldson, Jr., Village Clk., writes us that an ordinance has been approved for paving about one mile of street with brick, but that the work will not be done until after the water mains are laid.

PEORIA, ILL.—Bids are asked until April 2 for furnishing 52,500 lin. ft. of stone curbing, as stated in our advertising columns. Isaac Taylor, Comr. Pub. Wks.

DAVENPORT, IA.—Bids are asked until April 3 for paving several streets with brick, with stone curbing. E. W. Boynton, Com. Pub. Wks.

KEOKUK, IA.—W. H. Jones, Cy. Engr., writes us that the paving for 1895 will not be decided upon till after April.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until March 29 for reconstructing the pavements of 27 alleys.——Ordinances have been adopted for paving several streets with asphalt, the specifications admitting of competition on all kinds of asphalt.

HOUSTON, TEX.—Bids are asked until April 8 for constructing seven miles of paved roads in Harris county. John G. Todd, County Judge.

### MISCELLANEOUS CONTRACTS AND SUPPLIES.

DREDGING.—Brooklyn, N. Y.—Bids are asked until March 27 for dredging Gowanus Canal. A. T. White, Comr. G. Wks.

DREDGING.—Baltimore, Md.—Bids are asked until March 28 for about 100,000 cu. yds. of dredging. N. H. Hutton, Engr. Harbor Bd.

JETTY.—Portland, Ore.—Bids are asked until April 6 for building a jetty at Coquille River, Ore. Capt. Thos. W. Symons, U. S. Engr. Office.

DREDGING.—Portland, Me.—Bids are asked until April 15 for dredging, as stated in our advertising columns. Maj. D. P. Heap, U. S. Engr. Office.

BREAKWATER.—Davids Island, N. Y. H.—Bids are asked until April 12 for the construction of a breakwater. J. W. Summerhayes, Asst. Q. M., U. S. A.

FENCE.—Atlanta, Ga.—Bids are asked until March 27 for furnishing material and building a fence around Piedmont Park. Grant Wilkins, Ch. of Construction.

FOUNDRY.—Bristol, Conn.—The Sessions Foundry Co. has purchased 25 acres of land and will erect new buildings, as noted more fully under Industrial Notes.

ENGINE, LATHES, ETC.—Decatur, Ala.—The H. Mueller Mfg. Co. writes us that it is in the market for

a 60-HP. engine, a number of lathes, drop forge hammer, etc.

PIER WORK.—Philadelphia, Pa.—Bids are asked until April 2 for building two landing piers at Pea Patch Island, Delaware River. Second Lieut. Spencer Cosby, U. S. Engr. Office.

WATER POWER PLANT.—West Troy, N. Y.—Bids are asked until April 15 for the construction of a new water power plant. Maj. Isaac Arnold, Jr., Ord. Dept., Watervliet Arsenal.

RIVER IMPROVEMENTS.—Savannah, Ga.—Bids are asked until April 6 for river and harbor improvements, as stated in our advertising columns. Capt. O. M. Carter, U. S. Engr. Office.

CHIMNEYS.—Buffalo, N. Y.—The board of public works has been directed to secure plans and specifications and to advertise for bids for two brick or steel chimneys, to cost about $18,000.

STONE DIKES.—Cincinnati, O.—Bids are asked until April 16 for building loose stone dikes in the Ohio River, as stated in our advertising columns. Lieut.-Col. Amos Stickney, U. S. Engr. Office.

DREDGING.—Cleveland, O.—Bids are asked until April 1 for city dredging for five years. The bids recently received for this work were published in our issue of Feb. 21. J. H. Farley, Dir. Pub. Wks.

STEEL WIRE AND MANILA.—Boston, Mass.—Bids are asked until April 2 for 31,000 lbs. of galvanized steel wire and 25 tons of manila for the navy yard. Address Edwin Stewart, Paymaster-General, U. S. N., Washington, D. C.

COMPOSITE LIGHT VESSEL.—Washington, D. C.—Bids are asked until April 11 for furnishing the material and labor of all kinds necessary for the construction of one first-class composite light vessel No. 60. John G. Walker, Rear Admiral, U. S. N.

DREDGING.—New York, N. Y.—Bids are asked until April 8 for dredging in Thames River, near Norwich, Conn., New Haven Harbor, Conn., and Port Jefferson Harbor, N. Y., as stated in our advertising columns. Col. Henry M. Roberts, U. S. Engr. Office.

DAMS AND SHORE PROTECTION.—Rock Island, Ill.—Bids are asked at the U. S. Engr. Office until April 15 for constructing dams and shore protection on Upper Mississippi River, between Muscatine, Ia., and New Boston, Ill., as stated in our advertising columns.

PARK IMPROVEMENTS.—New York, N. Y.—Bids are asked by the department of parks until March 27 for the improvement of Corlears Hook Park, the work requiring 8,500 cu. yds. of excavation, 2,425 lin. ft. 6-in. stone curb, 4,900 lin. ft. 14-in. edging, 110,000 sq. ft. pavement, etc.

SELF-PROPELLING AUTOMATIC DUMPING BOAT.—New York, N. Y.—Bids are asked by the department of street cleaning until March 29 for furnishing one Delehanty self-propelling automatic dumper, capable of containing 600 cu. yds. of street sweepings, ashes and refuse, and to be in all respects seaworthy.

LICENSE TO CUT TIMBER.—Toronto, Ont.—Bids are asked until April 18 for the purchase of the license to cut the timber in the township of Lumsden, containing 36 square miles. This tract has never been cut over. The Vermillion River runs through it, and Chelmsford Station, on the Canada Pacific Ry., is seven miles distant. Thomas McCraken, No. 2 Victoria St., Toronto.

FIRE ENGINES, ETC.—Baltimore, Md.—Bids are asked until March 29 for two crane-neck, vertical piston, double steam fire engines, one of 750 and one of 650 gallons capacity, each to have the La France patent nest tube boiler, and for one 75-ft. Hayes extension ladder truck, all of same to have the necessary equipments, and the latest improvements; also for four hose wagons. J. A. Preston, Pres. Fire Comrs.

DOCK IMPROVEMENTS.—West Superior, Wis.—The Peyton, Kimball & Barber Co. will do considerable dredging on its own account the coming season, and has made a contract with Williams, Upham & Dougherty to do the work. The dredging will be done at the extreme end of Connor's Point, along the dock line, where the lumber company is building a dock 1,000 ft. in length. Tramways are being built through the yards to the dock.

DRAINAGE.—Cornwall, Ont.—A press report states that the Nation River drainage committee of the counties council of Stormont, Dundas and Glengarry has signed a contract with Beatty & Son, of Welland, for a $7,500 dredge for work on the Nation River. Of this sum the Ontario Government furnishes $4,000, the counties council $2,000 (balance of Dominion Government grant), and R. W. Weir, of Brinston's Corners, furnishes the balance of $1,500, taking a lien upon the dredge. The Dominion Government has agreed to go on with the dredging as soon as a suitable dredge is built. This work will render fertile a large area of land now useless, besides vastly improving many farms that suffer severely in wet seasons from inundation. The dredge will be completed by March 15.

## CONTRACT PRICES.

STOP COCKS.—Boston, Mass.—The "Herald" states that the water commissioners have awarded the contract for stop cocks to J. H. Long, at $5,363, the bids being as follows:

| | 20-in., 7. | 30-in., 4. | 36-in., 8. |
|---|---|---|---|
| J. H. Long | $145 | $287 | $400 |
| Geo. H. McLaughlin | 312 | 650 | 945 |
| Coffin Valve Co. | 125 | 275 | 425 |
| Atlantic Works | 225 | 464 | 630 |

CAST IRON PIPE.—Buffalo, N. Y.—The following bids were received for furnishing the city with cast iron water pipe during 1895: Buffalo Cast Iron Pipe Co., pipe, $18.50 per ton; castings, 2 cts. per lb. Charles F. Mensch, 36 and 48-in. pipe, $16.50; 4 and 16-in. pipe, $17.95; 36 and 48-in. castings, $45; 4 and 16-in. castings, $40.

SEWER BRICK AND IRON WORK.—Malden, Mass.—A contract for a supply of sewer brick has been awarded to A. W. Bryne, West Medford, at $8 per M. The bids for iron work for sewer frames and covers were as follows: Union Iron Works (on cars), $4.74; Chelmsford Foundry Co., $4.80; F. B. Hawkins & Co., $4.90; Mechanics Iron Foundry Co., $4.99; Concord Iron Foundry Co., $4.95; Osgood & Hart, $4.95; Springfield Foundry Co., $5.59; Sessions Foundry Co., $5.74.

SEWER PIPE.—Everett, Mass.—E. W. Lydston, Cy. Engr., writes us that the contract for a supply of sewer pipe has been awarded to Berry & Ferguson, Charlestown, Mass., at 67% discount, delivered on cars, or 66% delivered on ditch. There were seven bidders, each bidding 68% discount delivered on ditch.

Malden, Mass.—The street commissioners received five bids for a supply of sewer pipe, each offering 59% discount on extra bell and 67% on standard pipe.

SEWER PIPE AND CASTINGS.—Minneapolis, Minn.—The following bids were received for a supply of vitrified clay pipe:

| | Red Wing Sewer Pipe Co. | John H. Rich Sewer Pipe Wks. |
|---|---|---|
| 18-in. pipe, per ft. | $0.49 | $0.50 |
| 15-in. " " " | .32 | .31½ |
| 12-in. " " " | .22¾ | .12 |
| 9-in. " " " | .15 | .14½ |
| 6-in. " " " | .07 | .07½ |
| 6×18-in. Y bran., inc. stoppers, each | 2.00 | 2.05 |
| 6×15-in. " " " " " | 1.35 | 1.30 |
| 6×12-in. " " " " " | .98 | .95 |
| 6-in. slants, each | .25 | .24 |

The bids for sewer castings were as follows: Menzel Foundry, 1 1-5 cts. per lb.; S. T. Ferguson, $1.24¾ 100 lbs.

ARTESIAN WELL.—La Salle, Ill.—F. W. Matthiessen, Mayor, writes us that the contract for sinking an artesian well has been awarded to A. K. Wallen & Son, at $1.75 per ft.; the well to be 8 and 6 ins. in diameter. The other bidders were as follows: Whitney Artesian Well Co., St. Louis; Whitney Water Supply Co., St. Louis; W. H. Gray & Bro., Chicago; O. G. Wilson, Spring Valley, Ill.

WATER-WORKS.—Port Clinton, O.—Chas. E. De Witt, Engr., has sent us the following statement of the bids received Feb. 28 for furnishing material and constructing water-works; a statement of the bids sent by J. H. Faus, Clk., was published March 7, under Water-Works; contract awarded to Shaw, Kendall & Co., at $35,638:

Bids Received at Port Clinton, O., for Constructing Water-Works.

| Bidder. | Cast iron pipe, per ton (2,000 lbs.). | Special castings, per ton (2,000 lbs.). | Pipe line laid complete, including 66 hydrants, 32 valves and boxes. | Two 1,000,000-gallon compound duplex pumps in place. | Two 60-in. x 16-ft. hor. boilers, 1 feed pump and 1 heater in place. | 16-in. intake pipe in lake, 2,000 ft., per lin. ft. | Pumping station and stack. |
|---|---|---|---|---|---|---|---|
| Shaw, Kendall & Co.,* Toledo | $18.35 | $40.00 | $19,438 | $3,450 | $1,750 | $3.00 | $2,300 |
| Conley & Crossen, Sandusky | 19.05 | 45.00 | 20,123 | .... | .... | 4.20 | .... |
| Goodrich, Neal & Co., Winchester, Ind. | 19.00 | 50.00 | 19,803 | 2,350 | 2,050 | .. | 2,300 |
| Samuel I. Pope Co.,** Chicago | 20.25 | 45.00 | 21,697 | 2,288 | 2,391 | 4.25 | 2,380 |
| Deane Steam Pump Co., Chicago | .... | .... | ..... | 2,900 | 2,500 | .... | .... |
| Laidlaw-Dunn-Gordon Co., Cincinnati | .... | .... | ..... | 3,400 | 1,774 | .... | .... |
| Michael McKean, Sandusky | 20.62 | 47.00 | 23,980 | 2,350 | 1,950 | .... | .... |
| Thacher & Breyman, Toledo | .... | .... | ..... | .... | .... | 4.60 | .... |
| Ed. Bertsch, Port Clinton | .... | .... | ..... | .... | .... | .... | 2,285 |
| Hughes Steam Pump Co., Cleveland | .... | .... | ..... | 3,200 | .... | .... | .... |
| E. C. Cooke, Cleveland | .... | 42.50 | 21,470 | .... | .... | .... | .... |
| Snyder & Williams, Dayton | 18.05 | 40.00 | 19,523 | 3,000 | 1,643 | .... | .... |
| T. C. Brooks, Jackson, Mich. | 18.26 | 40.00 | 18,700 | 2,600 | 2,200 | 5.00 | 2,250 |
| Stilwell-Bierce & Smith-Vaile Co., Dayton | .... | .... | ..... | 3,029 | 2,000 | .... | .... |
| T. J. Prosser Co., St. Louis, Mo. | 23.00 | 46.00 | 29,014 | 2,585 | 2,250 | .... | 3,500 |
| Grimes & Moran, Elkhart, Ind. | 20.00 | 40.00 | 20,569 | 2,350 | 1,835 | .... | 3,000 |
| Phillips & Bixel, Cleveland | 18.05 | 40.00 | 18,869 | .... | .... | .... | .... |
| W. H. Ford & Co., Cleveland | 18.25 | 42.00 | 22,062 | .... | .... | .... | .... |
| Henry R. Worthington, Brooklyn, N. Y. | .... | .... | ..... | 3,475 | .... | .... | .... |
| John H. McGowan Co., Cincinnati | .... | .... | ..... | 2,600 | 1,900 | .... | .... |
| Chandler & Taylor, Indianapolis, Ind. | .... | .... | ..... | .... | 2,145 | .... | .... |
| William Day, Oak Harbor, O. | .... | .... | ..... | .... | .... | .... | 2,447 |

* Total, $35,638. ** Total, $40,823

BRICK PAVING.—Peoria, Ill.—A. D. Thompson, Asst. Cy. Engr., writes us as follows: Bids were opened March 12 for paving sundry streets and alleys with brick, the pavements to consist of one course small brick on 6 ins. broken stone concrete foundation. The following contractors were present and bid on the work: Henry Besler, Cedar Rapids, Ia.; John F. Bretz & Son, Springfield, Ill.; Mansfield & Allen, Indianapolis, Ind.; Fruin-Bambrick Construction Co., St. Louis, Mo.; Rockford Construction Co., Rockford, Ill.; John Traft, Dayton, Ky.; Talbot Paving Co., Detroit, Mich.; F. P. McCormick, Kansas City, Mo.; A. Mayfield, Lincoln, Ill.; Geo. S. Miller, Council Bluffs, Ia.; Day & Dougherty, Canton, Ill.; Robert Clark, Peoria, Ill.; Martin McDonald, Peoria, Ill; J. S. Allen, Peoria, Ill.; J. J. Jobst, Peoria, Ill.; Jas. Deal & Co., Peoria.

J. J. Jobst, of Peoria, Ill., was awarded the contracts on all streets excepting Fifth Ave., at $1.36 per sq. yd. for paving, 22 cts. per cu. yd. for excavation, and 6 cts. per lin. ft. for setting curb. His total bids were as follows:

| | |
|---|---|
| Second Ave. | $6,300 |
| Sixth Ave. | 13,768 |
| Walnut St. | 2,021 |
| Prairie St. | 2,100 |
| Alley Block 5 | 1,079 |
| Alley Block 11 | 1,164 |
| Alley Block 13 | 1,202 |
| Alley Block 15 | 1,194 |
| Alley Block 33 | 1,086 |

A Mayfield, of Lincoln, Ill., was awarded the contract for Fifth Ave. at $1.35 per sq. yd. for paving, 20 cts. per cu. yd. for excavation, and 9 cts. per lin. ft. for resetting curb; total bid, $13,734.

STONE AND BRICK PAVING.—Cleveland, O.—Our correspondent writes us that contracts have been awarded as follows, bids opened March 7: To Burgess & Gribben, five contracts for paving with dressed block Medina stone, one contract with sand foundation, at 30½ cts. per sq. ft., total contract $15,079; one with concrete foundation, at 36½ cts., total contract $15,810; three with sand foundation, at 30 cts., totals $37,153, $36,480 and $3,344; to Shields & Lauer, two contracts for common Medina stone on sand foundation, at 21¾ cts., totals $28,908 and $71,800; to M. F. Bramley, one contract for common Medina stone on sand, at 21 cts., total $29,887, and one contract for paving with Massilion blocks, at 11 cts. per sq. ft., total $11,146; to T. B. Townsend Brick & Contracting Co., one contract. Townsend block (Zanesville), at 12 cts. per sq. ft., with 6-in. Medina flagging, at 25 cts. per sq. ft. (about one-half the cost), total $3,967; to Peter Rothenbocker, three contracts for paving with Cleveland vitrified brick, 11, 10½ and 12 cts., totals $16,968, $10,922 and $4,764. The contracts for brick or block paving call for blocks 2½ x 8½ ins., and 5 ins. deep, with a sand foundation heavily rolled.

SEWERS.—Cleveland, O.—We are informed that the following contracts were awarded last week: To Theo. Mercier, Kennedy St. sewer, 27-in. brick, cut 10 ft., $1.78 per ft., 15 and 12-in. pipe, 72 and 65 cts., total $2,213; Wm. Lehman, Gordon Ave. sewer, 15 and 12-in. pipe, 59 and 44 cts., total $594; A. F. Helm, Hough Ave. sewer, 27 and 20-in. brick, $1.30 and $1.05, 18, 15 and 12-in. pipe, 60, 40 and 25 cts., total $2,239; Chas. & Dan McCarthy, Harvard St. sewer, 30 and 27-in. brick, $2.15 and $1.70, total $3,067; Fred P. Beers, Newell St. sewer, 12-in. pipe, 44 cts., total $234; Howard St. sewer, 15 and 12-in. pipe, 60 and 41 cts., total $619.

Erie, Pa.—The following contracts for tile sewers have been awarded: G. McCormick & Son, 12 in., average cut 13.46 ft., at $1 per ft.; 6-in., connections to curb, 25 cts. per ft.; 15 in., 13.5-ft. cut, $1; 6-in. connection, 19 cts.; E. Driscoll, 12-in., 15.22 ft. cut, $1.25; 6-in. connections, 25 cts.; V. D. Eichenlaub, 12-in., 13.5 ft. cut, 50 cts.; 6-in. connections, 25 cts.

Scranton, Pa.—Joseph P. Phillips, Cy. Engr., writes us that the following bids were received March 14 by the common council for the construction of a system of lateral sewers in section B of sewer district 13, ward 14; approximate estimate of cost, $7,671: Dunn Bros., Scranton, $6,912, or $2.13 per lin. ft.; extra manholes $38 each, extra catch basins $45 each; Bolton G. Coon, Kingston, Pa., $6,450, or $1.99 per lin. ft.; extra manholes $22 each, extra catch basins $18 each. These prices include the laying of house connections up to the fence lines; average depth about 9½ ft.

PUMPING ENGINES.—Dallas, Tex.—R. W. Havens, Cy. Engr., writes us that the following bids were received March 12 for a high-duty vertical compound pumping engine, capacity 10,000,000 gallons per 24 hours, against a head of 165 ft., and the same amount against a fire pressure of 280 lbs.; maximum boiler pressure, 90 lbs.:

| | |
|---|---|
| Holly Mfg. Co., Lockport, N. Y. | $29,500 |
| Henry R. Worthington, New York | 34,000 |

HARD MATERIAL SIDEWALKS.—Buffalo, N. Y.—The following bids were received March 6 for constructing hard material sidewalks from March 30, 1895, to March 30, 1896, aggregating about $25,000:

Buffalo Ferrolithic Paving Co.:
Ferrolithic ..... 23 cts.
Blue stone.... 4 ft., 22 cts.; 5 ft., 23 cts.; 6 ft., 25 cts

Brady & Maltby:
Ohio stone, all widths up to & includ. 6 ft..24 cts sq. ft.
Blue stone..4 ft. wide, 20 cts.; 5 ft., 22 cts.; 6 ft., 25 cts
Medina st'e..4 ft. wide, 30 cts.; 5 ft., 32 cts.; 6 ft., 41 cts.

Crandall & Knight:
North River blue stone... 4 ft. wide, 21½ cts. per sq. ft.
" " " " ... 5 ft. " 22½ " " " "
" " " " ... 6 ft. " 26½ " " " "

Henry Hartke:
Medina stone.....4, 6, 8 ft., 25, 35, 40 cts.
Blue stone.....4, 5, 6, 8 ft., 20, 23, 27, 30 cts.

E. D. Hofeller (Crescent P'v'g Co.): 23¾ cts. per sq. ft.

Geo. W. Moore:
Medina sandstone.....4, 5, 6 ft., 29, 32, 41 cts.
Blue stone.....4, 5, 6 ft., 21, 22, 27 cts.
Grading, per cu. yd. .....37 cts.

BOILERS.—Madison, Ind.—The water-works trustees have awarded the contract for two new boilers to C. R. Johnson, at $1,150. Chas. Henry bid $1,300, and the Madison Machine Co., $1,250. The work will require two boilers, each 40 ins. in diameter and 24 ft. long and having six 9-in. flues.

## METAL MARKET PRICES.

LEAD.—New York: 3.1 cts. Chicago: 2.9 to 2.92 cts. St. Louis: 2.9 cts.

NAILS.—Pittsburg: 90 cts. for wire, and 80 cts. for cut at mill in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.90; plain, $1.20 for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $12.50. Pittsburg: $10 to $11. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1 to 1.1 cts.; spikes, 1.45 to 1.6 cts.; track bolts, 1.75 to

1.85 cts. with square, and 1.9 to 2 cts. with hexagon nuts. Chicago: angle bars, 1.2 to 1.3 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11.50 to $12 for iron, and $10 to $10.50 for steel; steel rails fit for relaying, $14; light rails, $20 to $22; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $23 for standard sections; $25 for light sections; old rails, $10.50 to $11 for iron, and $7.50 to $10 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.2 to 1.3 cts. for tank, 1.35 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 3 cts. for locomotive firebox. Pittsburg: beams, 1.2 to 1.25 cts.; channels, 1.2 to 1.25 cts.; angles, 1.1 to 1.15 cts.; tees, 1.2 to 1.25 cts.; universal mill plates, 1.15 to 1.25 cts.; steel plates, 1.1 to 1.2 cts. for tank, 1.2 to 1.25 cts. for shell, 1.25 to 1.3 cts. for flange, 1.75 to 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.4 to 1.45 cts; channels, 1.4 to 1.45 cts.; angles, 1.3 to 1.35 cts.; tees, 1.6 to 1.7 cts., universal plates, 1.3 to 1.35 cts.; steel plates, 1.3 to 1.35 cts. for tank, 1.5 to 2 cts. for flange, 2 to 4.5 cts. for firebox.

## INDUSTRIAL NOTES.

THE ALABAMA PIPE CO., of Bessemer, Ala., is said to have had an attachment levied on its property.

THE MORGAN ENGINEERING CO., of Alliance, O., has an order for a plate shear for the Bethlehem Iron Co.

THE READING IRON CO., of Reading, Pa., has a contract for a large Morse cotton compress for a Texas cotton plant.

THE PITTSBURG LOCOMOTIVE WORKS, of Pittsburg, Pa., has an order for ten engines for the Trinity, Cameron & Western R. R.

EDWARD KENDALL & SONS, of Cambridgeport, Mass., have erected an extension to their plant for casting the pipes for the Water Board.

J. B. CLOW & SONS, of Chicago, Ill., whose pipe works at New Philadelphia, O., were destroyed by fire recently, will build its new plant at Dennison, O.

THE CRAIG-REYNOLDS FOUNDRY CO., of Dayton, O., has an order for four sets of crossing gates for the Southern Pacific Ry. at San Antonio, Tex.

THE OHIO VALLEY GAS CO., of Burgettstown, Pa., has completed a large pumping station at Barington, Pa. Steam is supplied by six boilers of 100 HP. each.

VENABLE BROTHERS, of Atlanta, Ga., have acquired control of the granite quarries of the Lexington Blue Granite Co., and will construct a branch railway 13 miles long.

THE C. W. HUNT CO., of New York, N. Y., has the contract for the coal and ash handling machinery in the new power station of the City & Suburban Ry., at Baltimore, Md.

THE YOUNGSTOWN BRIDGE CO., of Youngstown, O., has been awarded the contract for the structural steel work for the new Lafayette Square theatre at Washington, D. C.

THE AMERICAN HOIST & DERRICK CO., of St. Paul, Minn., has established an Eastern office in the Havemeyer Building, New York, with Mr. W. L. Manson, Manager, in charge.

WESTINGHOUSE, CHURCH, KERR & CO., of Pittsburg, Pa., have a contract for five engines (one of 250 HP. and four of 140 HP.) for the new electric light plant at Allegheny, Pa.

THE MADISON CAR CO., of Madison, Ill., has an order from the Trinity, Cameron & Western R. R. for 100 box cars and 100 flat cars, all of 60,000 lbs. capacity, and fitted with Gould couplers.

THE GRIFFIN CAR WHEEL CO., of Denver, Colo., and Chicago, Ill., has commenced work on the erection of its new plant at Denver. Mr. J. K. Choate is the Western representative of the company.

THE BETHLEHEM IRON CO., of Bethlehem, Pa., has resumed work at its steel mill, after a shut-down of two months. Work was commenced on an order for 12,000 tons of rails for a Georgia railway.

THE HOLLY MFG. CO., of Lockport, N. Y., has a contract from the city of La Crosse, Wis., for a high-duty vertical triple-expansion pumping engine of 10,000,000 gallons daily capacity. The engine is to be in operation by July 25.

ELISHA GREGORY, 48 Church St., New York city, informs us that he is putting down an 8-in. artesian well, 500 ft. deep, for the New Franklin Brewery, 3175 Austin St., Boston, Mass., and expects to have it completed in a few weeks.

THE SCHENECTADY LOCOMOTIVE WORKS, of Schenectady, N. Y., has already received more orders this year than during the whole of 1894, and will probably increase its force, the capacity with the present force being six engines per month.

THE DARRACH FENDER CO., of Newark, N. J., informs us that 150 of its car fenders have been in use for about a year on the Consolidated Traction Co.'s electric cars running between Jersey City, Newark and Orange, and have saved twelve lives in that time.

THE RADFORD PIPE & FOUNDRY CO., of Radford, Va., and Cincinnati, O., has had a temporary receiver appointed upon the petition of James N. Gamble and Archer Brown. This action is said to be the result of differences of opinion as to the policy of the company.

THE WALKER MFG. CO., of Cleveland, O., has a contract from W. W. Bierce, of Montgomery, Ala., for four 2,000-ton Taylor steam and hydraulic cotton compresses for immediate shipment, and has also orders for street railway generators of 100 to 1,000 HP., and for its spring mounted street railway motors of 25, 30 and 50 HP.

THE TRADERS' PAPER CO., of Lockport, N. Y., has been incorporated, with a capital of $300,000, to manufacture wood pulp and paper. The directors include J. A. Roberts, Comptroller of Buffalo, N. Y.; T. E. Ellsworth, and E. M. Ashley, of Lockport, and W. M. Ivins, of New York. It is expected that the old Jackson mills will be used as a plant.

R. W. HILDRETH & CO., of New York, civil and inspecting engineers, announce that they will represent in this country and will be represented in England by the firm of Thomas Nash & Son, inspecting engineers, of Sheffield, England. They are therefore in a position to test and inspect all kinds of engineering material, etc., either in this country or in Great Britain.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has lately completed an iron bridge 350 ft. long and 20 ft. wide for the town of Barrington, R. I. The company has a contract for the new building for the Bonta Plate Glass Co., of Scranton, Pa., which will be 140 × 114 ft. long, covered with the Berlin company's patent anti-condensation corrugated iron roof covering.

MACKINTOSH, HEMPHILL & CO., of Pittsburg, Pa., have an order from the Bethlehem Iron Co. for a 32-in. slabbing mill, for slabbing down ingots, which will be driven by two 28 × 48-in. and two 46 × 60-in. reversing engines. The order also includes a 34-in. plate mill, driven by an automatic cut-off engine with cylinders 46 × 60 ins., and a 26-in. universal mill driven by two reversing engines with cylinders 42 × 60 ins.

THE PIONEER RAIL RENEWING CO. has been organized at Milwaukee, Wis., for the purpose of operating under a recent patent on a process of renewing old steel rails, and for the purpose of conducting a business of rolling and rerolling and renewing all kinds of rails, etc. The capital stock is $50,000, and the incorporators are James C. Pond, Edgar C. Hoe and Thomas H. Gill, all of the Wisconsin Central Ry.

THE H. MUELLER MFG. CO., of Decatur, Ala., informs us that it has recently sold its factory building in Decatur, and is seeking a new location. The company manufactures water-works and plumbers' supplies, and employs 65 hands at the present time, but expects to increase its force if it can find the right location for its plant. The company expects a liberal bonus to move its factory to any city, and is now ready to correspond with any city in relation to establishing its factory. It is also in the market for a 60-HP. engine, a number of lathes, drop forge hammer, etc.

THE NEW YORK & NEW JERSEY GRANITE & PAVING CO. has been organized to work quarries near Pompton, N. J., and to supply paving blocks, broken stone, dimension stone, etc., and has already on hand contracts for work in several cities, and for broken stone for 118 miles of roadway in Morris county, N. J. It also deals in and refines all kinds of asphalt, and has closed contracts with the La Brea Co., of Trinidad, for $400,000 worth of crude asphalt. The capital stock is $500,000. Pres., L. H. Doremus; Secy. and Treas., James J. Langan; Gen. Man., James Jackson; Gen. Supt. of Asphalt Dept., Robert Alexander. The offices are in the Postal Telegraph Building, Broadway and Murray Sts., New York city.

THE HOLLY MFG. CO., of Lockport, N. Y., informs us that, through its General Agent, P. H. Linneen, it has been awarded the contract by the city of Chicago for five pumping engines of the following styles and capacities: One high-duty horizontal Gaskill pumping engine of 14,000,000 gallons daily capacity, to be erected in the Lake View pumping station; one horizontal compound high-duty Gaskill pumping engine of 14,000,000 gallons daily capacity, to be erected at the 68th St. pumping station; two vertical cross-compound high-duty pumping engines of 15,000,000 gallons daily capacity each, to be erected at the Chicago Ave. pumping station; one vertical triple-expansion pumping engine of 30,000,000 gallons daily capacity, to be erected in the 14th St. pumping station. The amounts of the contracts will aggregate about $276,000.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has recently received an order through Mr. T. P. Shonts, General Manager of the Indiana, Illinois & Iowa R. R., for the interlocking plant at the crossing of that road by the Baltimore & Ohio and Lake Erie & Western railways at Walkerton, Ind. The machine will consist of 44 working levers and 8 spare spaces, operating 21 switches, 7 locks, 14 F. P. locks and three crossing bars and 25 signals. In order to obtain view of all the tracks within the limits of the interlocking, the tower is to be 25 ft. high to the operating floor. One special feature of this plant is that switch and lock movements are not used on the main running tracks, and also but one selector, and it is claimed that limiting the use of switch and lock movements in this way adds greatly to the simplicity and efficiency of the plant.

THE MISSOURI VALLEY BRIDGE & IRON WORKS, of Leavenworth, Kan. (A. J. Tullock, Proprietor), informs us that it has just completed an important bridge across Atchafayala Bayou, Louisiana, on the Texas & Pacific Ry.; it consists of one span of 250 ft. and two pneumatic piers, each pier consisting of two double cylinders 8 ft. diameter and over 140 ft. long. It has likewise just furnished 11 plate girder spans from 50 to 65 ft. long and 2 through spans 103 ft. long for the Atchison, Topeka & Santa Fe Ry.; 3 spans of 150 ft. for the Santa Fe, Prescott & Phoenix Ry.; 2 spans for the Kansas City, Osceola & Southern Ry., and is about completing the substructure for the new bridge across the Big Black River east of Vicksburg on the Cincinnati, New Orleans & Texas Pacific Ry., consisting of four steel tubular piers from 70 to 80 ft. long. The contracts on hand for the current year comprise a new railway bridge across the Arkansas River at Little Rock, Ark., and a new bridge across the Missouri River at Jefferson City, Mo., for highway and street car traffic.

THE F. D. CUMMER & SON CO., of Cleveland, O., manufacturing hot air apparatus, ore roasters, dry kilns, etc., writes us that it has recently supplied one of its hot air systems, of large capacity, for drying bricks, terra cotta, pottery, lumber, etc., to a prominent brick and terra cotta company in England, and that it has also received an order by cable from Belfast, Ireland, ordering a system for a large brick-making concern in that city. It is now erecting a large system for a concern in Canada, which apparatus will be used in drying moss. This moss is used as a bedding for horses and other animals, and has a very wide use besides in a general way for antiseptic purposes, the material when dried being capable of absorbing 15 to 18 times its dried weight of moisture and volatile properties from materials with which it is mingled. The company has also received an order from England from a concern which is said to be the largest manufacutrer of soda ash in the world, for one of its largest drying machines, which is to be used in calcining the carbonate of soda. The Ironton Brick Co., of Ironton, O., has placed an order for a hot air plant for drying its bricks. The company claims that its hot air system will do at least twice as much drying with a given amount of fuel as any other system, and states that in one case its system is doing over three times as much work with a given amount of fuel as the steam system which it displaced.

THE SESSIONS FOUNDRY CO., of Bristol, Conn., writes us that it has purchased 26 acres of land at the north end of the town, where the new electric railway is to start from, and expects to build large and complete new works for its business at once. This tract of land has a frontage of 900 ft. on the railway, and there will be five or six spur tracks running into the different departments for receiving and shipping. A small locomotive will be used for handling cars in the yards. The main foundry building is to be 500 × 110 ft.; shipping building, 300 × 70 ft.; pattern shop, 60 × 80 ft., two stories; pattern storage building, 50 × 100 ft., two stories. Also a large power house and an office. All the buildings are to be of brick, except the office, which is to be of granite. The main buildings will have steel trusses and plank roofing, covered with slate. There will be about 40,000 cu. yds. of grading, an iron and fuel stock yard 10 ft. higher than the foundry floor, with a retaining wall about 400 ft. long on the back and the same on the front. The blowers and other machinery are to be run by electrical power, and the heating of all the buildings is to be done by steam with the blowing system. There will be a large amount of skylights, and the works will be lighted by its own electric plant. The plans are now being made by Davis & Barnes, of Philadelphia (who have been till recently with the Pencoyd Iron Works), and these plans will be completed within a short time.

NEW COMPANIES.—Murray Pneumatic Railway Gate & Signal Co., Chicago, Ill.; J. G. McMichael, John W. Murray and P. A. Hurd.

Wright Gas Co., Lorain, O.; $100,000; Jas. B. Hoge, Charles L. Penney and S. S. Cox.

Sacandaga Sand Co., Groversville, N. Y.; $20,000; C. A. Alvord, W. H. Seymour and E. Brown Baker.

McKenna Steel Working Co., Milwaukee, Wis.; $4,000; Thomas H. Gill, Edgar C. Hoe and James C. Pond.

American Fireproofing Co., Chicago, Ill.; $50,000; Carlos H. Hardy, M. L. Kendig and J. C. Sternheim.

Zindorf Construction Co., Seattle, Wash.; $70,000; general contracting; M. P. Zindorf and H. J. Zindorf.

Pennsburg Mfg. Co., Pennsburg, Pa.; $25,000, with $2,500 paid in; Treas., J. R. Kauffman, Jr., Sunbury, Pa.

Pioneer Rail Renewing Co., Milwaukee, Wis.; $50,000; Edgar C. Hoe, Thomas H. Gill and James C. Pond.

Chicago Truck & Steel Casting Co., Chicago, Ill.; $150,000; George H. Graham, G. G. Taylor and M. J. Brady.

Oppenheimer Brick & Tile Co., San Antonio, Tex.; $50,000; Daniel Anton, Henry Oppenheimer and Emil Caisen.

Dunkirk Steel & Iron Co., Chicago, Ill.; $200,000; Edward C. Foster, Henry L. Wilson and John A. McKeever.

East St. Louis Rolling Stock Co., East St. Louis, Ill.; $50,000; H. D. Sexton, Stephen D. Sexton and M. C. McLean.

Standard Gas Co., Chicago, Ill.; $400,000; gas works plant; D. B. Parks, W. E. Pinckney and Jackson F. Randolph.

Dayton Gas Engine & Mfg. Co., Dayton, O.; $40,000; Edward E. Euchenhofer, C. J. Weinman and E. Morgan Wood.

National Asphalt Roofing Co., East St. Louis, Ill.; $25,000; Charles W. S. Cobb, F. W. Terpening and J. B. Johnson.

Griffin Wheel Co., Denver, Colo., and Chicago, Ill.; $1,000,000; Thomas A. Griffin, J. P. Geraghty and A. C. Wellington.

Wilder Mfg. Co., Philadelphia, Pa.; $50,000, with $5,000 paid in; iron and steel; Treas., Henry C. England, Reading, Pa.

Ossining Lime Co., Ossining, N. Y.; $10,000; Wm. W. Smith and E. J. Satterlee, of Sing Sing, N. Y.; Thomas Maguire, New York.

MacDonnell Engineering Co., Chicago, Ill.; $50,000; machinery manufacture; James MacDonnell, John M. Witherson and R. M. Burns.

East Oakland Constructing & Paving Co., Oakland, Cal.; $10,000, all paid in; E. P. Vandercook, P. J. Peterson and Chas. E. Snook.

Willard & Frick Mfg. Co., Rochester, N. Y.; $40,000; the Rochester pipe cleaner; J. Louis Willard, Frederick A. Frick and Frederick James.

Trueb Automatic Thermo-Regulator & Car Equipment Co., New York, N. Y.; $25,000; J. Haffellfinger, J. J. Trueb and Henry Schrolter.

James C. Lindsay Hardware Co., Pittsburg, Pa.; $150,000, with $15,000 paid in; iron and steel manufacture; Treas., Julius McFarland Cecil.

Ellithorpe Elevator Safety Construction Co., New York, N. Y.; $50,000; Frederick T. Ellithorpe, Newark, N. J.; Peter G. Van Zandt, Jersey City, N. J.

Warren Webster & Co., Camden, N. J.; $150,000, with $1,000 paid in; machinery and railway supplies; Warren Webster and A. Spencer Webster, Merchantville, N. J.

Wm. & Harvey Rowland Co., Philadelphia, Pa.; $150,000, with $15,000 paid in; iron and steel work, pipe, etc.; Treas., Edward Rowland, 2029 Spruce St., Philadelphia, Pa.

International Railway Construction Co., Passaic, N. J.; $100,000, with $1,000 paid in; Edwin Gould, Dobbs Ferry, N. Y.; Wm. T. Hutchinson, Passaic, N. J.; J. G. Baldwin, Jr., New York, N. Y.

Joseph Schneible Co., Elizabeth, N. J.; $50,000, with $2,000 paid in; gas making machinery and gas fittings; Joseph Schneible, Edward A. Greeley, of New York, N. Y.; George H. Bridgeman, of Elizabeth.

Peter Ballingall Co., Atlantic City, N. J.; $60,000, with $6,000 paid in; railways, gas and electric light plants, etc.; Peter Ballingall and James Brown, of Philadelphia, Pa.; Winfield S. Laumaster, of Atlantic City, N. J.